RAILROAD GAZETTE

FRIDAY, JULY 11, 1902.

CONTENTS

ILLUSTRATED:

The Ohio River Bridge at Marietta, Ohio. 546
Early History of the Delaware, Lackawanna & Western Railroad and Its Locomotives. 548
A Trunnion Bascule Bridge. 550
Modern Water Supply for Locomotives. 551
A New "Little Giant" Drill. 553
Compound Consolidation for the Wheeling & Lake Erie 557

CONTRIBUTIONS:

A Special Trial of Emery Wheels as to Strength. 545

EDITORIAL:

Track in Tunnels—Some New Questions. 554
Signaling Fast Trains in Fog. 554
Editorial Notes 555
New Publications 555
Trade Catalogues 555

MISCELLANEOUS:

Car Lighting 545
The Block System on the Atchison in Colorado. 547
Railroad Legislation in Massachusetts. 547
Roundhouse Air-Brake Work—Inspection and Repairs 549
A Broken Axle and a Derailment. 553
Chicago Freight Handlers Strike. 553
The River and Harbor Bill. 556
English and American Railroad Rates. 556

GENERAL NEWS:

Technical 558
The Scrap Heap. 559
Locomotive Building 560
Car Building 560
Bridge Building 560
Meetings and Announcements. 560
Personal 561
Elections and Appointments. 561
Railroad Construction 561
General Railroad News. 562

Contributions

A Special Trial of Emery Wheels as to Strength.

Stroudsburg, Pa., June 30, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the year 1891 you published a verbatim report as to a comparative test of solid emery wheels, which test was carried out at the Stevens Institute. This test was made by a committee of experts, authorized by The Tanite Company to test, at its expense, every variety of solid emery wheel made in the United States. The verdict of this committee was, that among the 15 varieties tested, the Tanite wheel had only "one rival." The publication of this report created a storm of antagonism, and the *Railroad Gazette* published one letter which asserted that such a scientific test was worthless, and that "commercial acceptability" was the correct standard. The present writer gave answer in your columns to this letter, and argued that scientific tests affixed the correct standards to processes, machines and mechanical appliances; pointing out that if commercial acceptability proved real value, then an unlimited amount of absolute rubbish was proved valuable by its commercial acceptability.

The high rank given to the Tanite wheel by this investigation was of much less importance than the unqualified verdict of the committee, that, out of 15 varieties, six were "too unsafe to warrant their general use." Notwithstanding this verdict, the stamp of commercial acceptability still imprints several varieties of wheels, which, in the writer's opinion, were then, are now, and always will be essentially unsafe. In a lecture on emery wheels printed in the *Journal of the Franklin Institute*, March, 1890, emery wheels were arranged in three general divisions, the safe and unsafe varieties being indicated by classes. The Stevens Institute report mentioned by name the 15 varieties which were tested, but did not identify results by name, except so far as the Tanite wheel was concerned. The publication of this report, and the opinions expressed in advertisements, catalogues, circulars, etc., might be considered by the public merely as puffs of the Tanite wheel, and the test in question was objected to because it was made under the auspices of the Tanite Company.

Now, however, after a lapse of 10 years, unsolicited and impartial testimony has been brought out on the same subject. Under date of March 5, 1901, the Association of German Engineers (Verein deutscher Ingenieure) issued at Berlin a circular, stating that they had appropriated money for a speed trial of emery wheels, and that Prof. Grübler, of the Technical High School at Dresden, had agreed to make the trials. Their circular requested the sending of trial wheels. We have been indirectly informed that there are in Germany legal restrictions as to the speed of emery wheels, the result of which is over-great pressure, with uneven wear and reduced product, and that the object of this test was to modify such restrictions. The purpose of the inquiry was to arrive at some verified data as to the speed which solid emery wheels could safely endure.

The trial in question has been made, and under date of May, 1902, Prof. Grübler has issued a preliminary report. He states that a full one will be published, with a description of the apparatus and the tests. Without waiting for this full statement, we desire to give a brief analysis of the preliminary report. It appears that 10 different concerns submitted wheels for trial, seven of these concerns being European and three American, one set each from The Boston Emery Wheel Co., Worcester, Mass., and from The Tanite Co., Stroudsburg, Pa., and one wheel from The Safety Emery Wheel Co., Springfield, Ohio. The number of wheels tested was 54, and their size practically the same. There were variations of a few millimeters in diameter and thickness, but not enough to materially affect the speed test. Practically the wheels were 500 mm. in diameter and 50 mm. thick. The speed at which these wheels burst from centrifugal force, and the strength of the wheels are the facts set forth in this preliminary report.

If the risk of explosion due to centrifugal force alone was the one and only thing to fear, then this test ought to quiet all dread. The wheels tested were practically 20 in. in diameter, and the speed affixed to the 20 in. wheel in The Tanite Company's catalogue is 1,080 revolutions per minute. While some few American concerns have, in the past, advocated a lower rate of speed, and while one concern has advocated a higher, the industry has been almost unanimous in adopting the approximate speed of a mile a minute for a point on the circumference of the wheel as the standard speed. Assuming 1,080 revolutions per minute to be the average standard for a 20-in. wheel, then we find that the average speed at which the 54 wheels broke was 3,312, or more than three times the standard speed.

In this test of 54 different wheels, the highest breaking point was 4,210, the lowest 2,520, the average 3,312.

The greatest strength was 251.3 kilos., the least strength 73.9 kilos., the average strength 159.1 kilos.

The following tabulation gives the important results. Prof. Grübler states that he has calculated the strength (Festigkeit) according to some formula of his own, to whose publication he refers. We infer that he has deduced the strength from the weight and the circumferential speed. The heaviest wheel weighed 34.95 kilos., and the lightest only 20.01. The highest circumferential velocity per second in meters was 110.44, the lowest 64.72. In these factors probably lies the reason why the strength column does not follow the same order as the bursting point column.

No.	Rev. per min. when bursting occurred	Nature of binding material.	Strength in kilos.	
1	4,063	Vegetable.	251.3	European. Average of 3 wheels.
2	3,967	Vegetable.	238.8	European. Average of 3 wheels.
3	3,770	Mineral.	182.7	European. Average of 3 wheels.
4	3,737	Not stated.	201.4	European. Average of 3 wheels.
5	3,727	Vegetable.	198.6	European. Average of 3 wheels.
6	3,647	Animal.	190.5	Tanite. Average of 3 wheels.
7	3,643	Vegetable.	212.9.	European. Average of 3 wheels
8	3,493	Vegetable.	184.2	European. Average of 3 wheels.
9	3,307	Mineral.	155.4	European. Average of 3 wheels.
10	3,237	Mineral.	153.0	European. Average of 3 wheels.
11	3,177	Chemical.	125.8	European. Average of 3 wheels.
12	3,040	Vegetable.	140.4	European. Average of 3 wheels.
13	2,953	Chemical.	108.3	European. Average of 3 wheels.
14	2,940	Mineral.	134.2	European. Average of 3 wheels.
15	2,840	Chemical.	88.2	European. Average of 3 wheels.
16	2,807	Mineral.	123.4	European. Average of 3 wheels.
17	2,760	Not stated.	96.8	Safety. 1 wheel only.
18	2,680	Chemical.	95.7	Norton. Average of 3 wheels.
19	2,615	Chemical.	73.9	European. Average of 2 wheels.

Sample sets of three wheels each were asked for, each set to be of absolutely the same binding material.

This test, as thus far reported, seems to be a vindication of The Tanite Company's report previously alluded to, and it also substantiates the claims made in 1890 by the present writer, that certain classes of wheels were less safe than others. In the lecture on emery wheels previously alluded to, the three classes were said to include respectively: First, vitrified wheels; second, artificial stone wheels, and third (which were said to be made on better principles), wheels composed of glue, shellac, oxidized linseed oil, rubber, celluloid and tanite. This third class, therefore, has either a vegetable or animal "binding"—as the German report designates it. Unless wheel four should prove to be mineral the seven stronger sets are all vegetable or animal, and all the remainder save one (and one unknown) mineral or chemical. In other words the vitrified and artificial stone wheels are proved the weaker. Thus far as to the test, which, in our opinion, is conclusive on one point only, and that is as to the bursting point of emery wheels, and the risk due merely to speed and the effects of centrifugal force. As emery wheels are meant for grinding purposes, they are seldom run free in this way; and, as the bursting point is shown to be a speed three times in excess of the average standard speed for wheels when in use, there seems to be no reason to dread danger from this source.

It cannot be too clearly pointed out that the great cause for the explosion of emery wheels is the combination of heat and pressure due to their use in grinding. We are justified in assuming that if these 54 wheels had been put to the practical test of grinding under absolutely like conditions, a very different series of figures would have resulted. Upon this fact depends the very much greater value of the investigation carried out for The Tanite Company. In that investigation preliminary experiments were made to arrive at the fact of what might reasonably be called light, medium and heavy grinding by hand. These facts having been arrived at, a machine was constructed with a view of eliminating the personal factor, the pressure being mechanically applied. The subsequent experiments were made upon test bars, every precaution being taken that speed, pressure, and all other conditions should be absolutely alike in every case. That investigation clearly settled the fact that wheels with vegetable and animal binding were safer than vitrified or concrete wheels; in other words, safer than wheels with so-called mineral and chemical binding.

In view of these two separate investigations, it seems clear that every user of solid emery wheels who regards the safety of his men and his own liability to suit for damage should discard "commercial acceptability" as a standard—should place only moderate dependence on safety appliances, and should, above all things, select solid emery wheels which are made by such processes and out of such materials as have been proved by careful experiment to yield wheels best able to withstand high speeds and the disrupting effects of heat and pressure.

T. DUNKIN PARET, *President of The Tanite Co.*

Car Lighting.

At the Master Car Builders' Convention Mr. L. T. Canfield, M. C. B., Delaware, Lackawanna & Western, presented the following paper as a topical discussion:

The introduction of the Pintsch light advanced the efficiency of car lighting to such an extent that there is not the same chance for improvement over the Pintsch as there was between the oil lamp and the Pintsch. . . . Acetylene gas gives a very bright light of pure white rays. It is the most diffusive light we have, and approaches the sunlight more nearly than any other light known. Cars equipped with it have burners that consume one-half cubic foot of gas per hour, and give a light of 35 candle power, while the Pintsch gas uses a burner that consumes about 2 cu. ft. of gas per hour, and gives a light of 25 candle power. . . . A method of storing acetylene gas was discovered by two French inventors, who found that one volume of acetone under ordinary temperature and pressure dissolved 25 volumes of acetylene and under 12 atmospheres of pressure would dissolve 300 volumes of acetylene. Acetylene is very explosive under compression, and was prohibited in England under the Explosive Act in 1873, but under the provisions of said act, it being shown that reservoirs packed with porous brick, acetone and acetylene were not explosive or possessed of explosive properties, the Secretary of State exempted it from being deemed an explosive April 10, 1891.

In the reservoir for storing this gas the porous brick, or asbestos, which is sometimes used, is simply for the prevention of explosion. The acetone is for the storing of gas in large quantities in small space, and does not enter into the quality or efficiency of the light. The bricks are first made of a mixture of clay and powdered charcoal. The baking of them burns out the charcoal, leaving a porous brick, with which the storage reservoirs are packed. If these bricks were pressed solid closing up the openings made by the burning out of the charcoal, the solid substance would take up 20 per cent. of the space within the reservoir. Forty-three per cent. of the reservoir would be filled with acetone, leaving 37 per cent. of the space for expansion. A reservoir 20 in. in diameter by 10 in. long filled as stated above, charged with acetylene gas at 165 lbs. pressure per square inch was placed upon a car on the Delaware, Lackawanna & Western having four lamps with three burners each and one lamp with one burner. This gas burned a total of 260 consecutive hours and was in service from March 4, 1902, to May 12 of the same year, without recharging. The fact of being able to run the car so long without recharging makes this a very desirable light.

The application is very similar to the application of the Pintsch light and gives less trouble, from the fact that we do not have to fill the reservoirs as frequently. There is one thing, however, that is necessary, and that is, to have a successful light the gas must be kept cool, consequently the pipe leading to the burner instead of coming down through the center of the lamp must be brought down on the outside placing the burner on the end and above the pipe. Cars equipped with this system are the best lighted we have. . . .

The electric light in my opinion is the most important of all. . . . The makers of electric lights for railroad cars should be encouraged by giving them an opportunity to develop their devices. I do not think there is any system far enough advanced to warrant its general adoption, but great strides have been made in the past three years, and if followed up carefully I am satisfied that the cost of maintenance will be greatly lessened. The principal objections to lighting with electricity are its cost of installation and the cost of maintenance. . . . The storage battery, while maintaining a steady light, is objectionable in its present form on account of its excessive weight; its limited reserve capacity; the necessary large proportion of time the car is kept out of service for recharging or the amount of labor required to change the batteries, and the limiting of the movement of cars so equipped to special runs.

The second, or steam-driven motor system, is objectionable on account of the expense of operating, . . . and the excessive vibrations felt throughout the train when the engine is running the dynamo; the vibrations of the voltage at the lamps by the variations of the steam supply to the engine from the boiler of the locomotive; the danger of fire on account of the high voltage; also the limiting of movement of cars so equipped to special runs which destroys the mobility of the railroad company's car equipment as a whole.

The third, or axle lighting system, which in my mind is the best system in use to-day on account of allowing of the free movement of cars. . . . This system may

be divided into two classes, one of which uses the so-called automatic regulator for maintaining the output of the dynamo constant by varying the strength of the field coils, thus keeping the voltage of the machine the same as that required by the lamp; but this regulator is such a delicate machine that the rough usage to which it is subjected puts it out of order very frequently. Besides, as far as I can learn, there has not as yet been made a perfect automatic regulating device for governing the flow or intensity of an electric current, and while they may be called automatic, and probably are automatic for a short time, they cannot be relied on. The other design depends upon the slipping of the belt on the pulley for maintaining the voltage of the dynamo constant, and as you all know, the varying changes of the atmospheric conditions will affect the belt, and at the best this is a very crude and unsatisfactory way of attaining the desired effect, it requiring constant attention as it is not automatic.

In operating the axle lighting system, it is necessary to handle it with a great deal of care. The batteries must be charged immediately after they are set up, as the plates will rapidly deteriorate if they are left standing in the uncharged diluted sulphuric acid which is used. Again you must not charge or discharge same too fast for fear of buckling the plates, and when a new battery is placed in service, it is necessary to charge and discharge it several times. If the battery is overcharged, charged or discharged too fast it has the effect of sulphating the plates, which increases the internal resistance of the battery and also uses up these plates, and destroys the battery much sooner than in ordinary use. I will . . . point out a few of the faults showing what we have to contend with in trying to keep the lights burning when required. The dynamo does not become operative until the train has reached a certain speed, about 12 miles per hour, called the critical speed. In suburban service, for instance, if from any cause the batteries are run down, that is, nearly all of the stored electricity in them is used, you will not get the benefit of the dynamo in recharging them or helping to supply the light until the critical speed is reached, and in many cases about or before the time this speed is attained it is necessary to slow down the train for the next stop. Therefore you are not generating any electricity, but your lights are burning all the time and using it continually from the storage battery, consequently you are going deeper and deeper into trouble, on account of the lights growing dimmer and sometimes going out when the train is standing still, or is running below the critical speed. At this time of the year we naturally have very little trouble, but in the winter time when the days are short, and it is necessary to use the light for a longer period of time, it is different. On through service you will not, of course, have this particular trouble to contend with, but in the operating of this kind of light the belts occasionally jump off of the pulleys or break, the battery becomes defective, the regulators get out of order, the fuse burns out, there is a short circuit, a wire is broken, the armature burns out, the armature shaft breaks, the dynamo runs hot, the commutator is out of order, or something in the system gives out or goes wrong, and the lights become dim or go out altogether, then we are in trouble. At the present stage of electric lighting it is absolutely necessary to have an auxiliary light at hand to fall back on. I am sure many of us who have had experience with this light would be perfectly satisfied to do away with it on account of the trouble it has caused—but this is an age of progress and there is no doubt but that there will continually be improvements made in electric car lighting. When it is so perfected that it will not require an expense greatly in excess of that necessary to maintain the gas lamp of to-day I am sure it will come into general use. One point I wish to call your attention to is the fact that the dynamo should be hung to the bottom of the car where it would receive the benefits of both elliptic and equalizer springs to relieve it of all the shocks possible. Another thing, a long belt is desirable in preference to a short one on account of allowing the dynamo to adjust itself to the lateral motion of the axle; but it is absolutely necessary to have the perfect belt cover so as to increase the life of the belt.

I will conclude by reading a statement comparing the cost to our company of each kind of light for one month.

First-class Cars.

Kind of light.	No. of lights.	Average. mileage.	Cost per car.	Cost per flame.	Kind of service.
Oil	6	12,710	$2.40	$0.40	Through
Electric lights...	17	2,092	8.81	.52	Suburban
Electric lights...	36	12,710	37.31	1.04	Through
Electric lights...	25	1,560	7.57	.30	Suburban
Pintsch gas.....	20	12,710	5.73	.29	Through
Pintsch gas.....	16	2,092	2.45	.15	Suburban

DISCUSSION.

Mr. F. W. Brazier—I am very thankful to Mr. Canfield for this able paper. I think he has two systems on his road which we have in use on our road. I ask if he has had much trouble with the belt covers on axle-driven lights?

Mr. Canfield—We did have considerable trouble with one device. The manufacturer made several attempts to apply a belt-cover, but none were successful. We took the two cars in our shop a little over two months ago and applied a belt-cover of our own design and have had no trouble with the system since that time. We have had what might be termed a perfect light. We have applied gas as an auxiliary, but have not had to light the gas since the system was put on. With the other system the company furnished a belt-cover that has not given trouble.

Mr. Brazier—On our dining cars, on the Lake Shore Limited, we use the axle driven light. We had considerable trouble with the belt covers until we designed one ourselves which gives satisfaction. Mr. Canfield's figures are interesting and about the same as ours in comparison with electric lights and Pintsch gas. The New York Central has something like 1,400 cars lighted with Pintsch gas with good results.

Mr. Whyte—I ask how Mr. Canfield gets at the cost of coal for running the axle light?

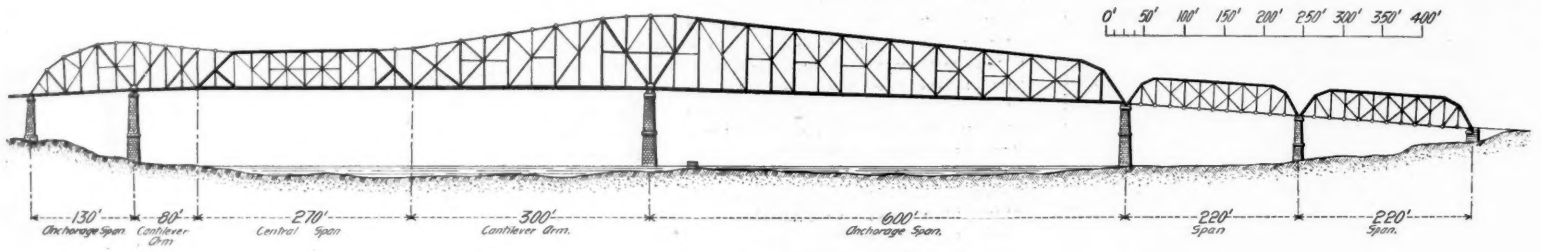
Mr. Canfield—We do not get at that at all. We did not attempt to get the cost of coal in that case. It is generally known that very little power is required to drive the dynamo and it is not worth while figuring the extra cost for making the steam required for running the dynamo. . . .

Mr. R. D. Smith—I am interested in this subject, having followed it up closely, and have had some considerable experience in keeping figures for the cost of different systems of lighting, but in view of some of the figures presented in Mr. Canfield's paper, I could not possibly give the figures, as the management might get after me and want to know what we are spending the money for. I would like to see the subject go to a committee, and with that in view I would move that the subject be referred to the executive committee with a request that they appoint a committee to report on the subject at the next convention. (Carried.)

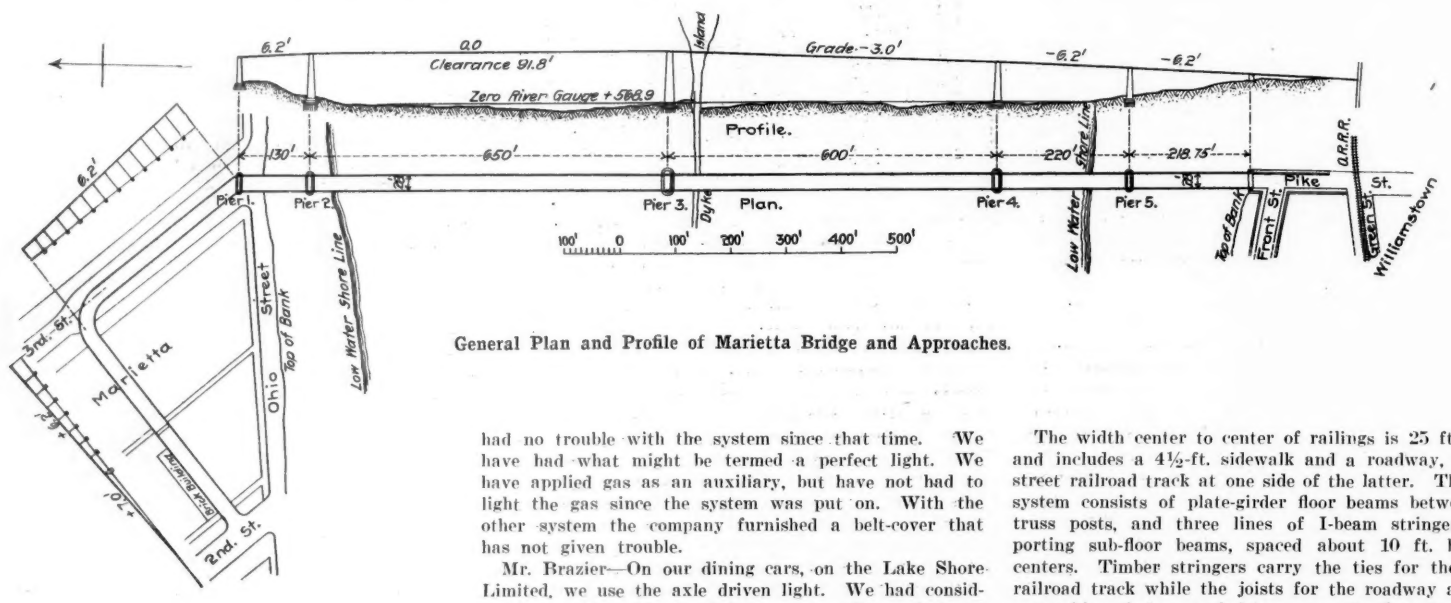
The Ohio River Bridge at Marietta, Ohio.

A cantilever highway bridge of peculiar design is about to be built over the Ohio River at Marietta, Ohio, by the Ohio River Bridge & Ferry Co., Mr. B. G. Dawes, President, which now operates a steam ferry, and is interested in an electric railroad on the south side of the river (opposite Marietta), running from the bridge site to Parkersburg, W. Va. The design was prepared by Mr. C. L. Strobel, Chicago, M. Am. Soc. C. E., who is the Consulting Engineer of the company, and the contract for the superstructure has been awarded to the American Bridge Company, the date for its completion being Jan. 1, 1903.

The length of the south anchorage span is 600 ft., while that of the north anchorage span is only 130 ft. This arrangement resulted from the necessity of maintaining two navigable channels (the position of the three channel piers being fixed by the War Department), and by the fact that the north approach is a viaduct with a sharp curve, giving very little room for the anchorage span between the channel pier and the curve. The main channel span is 650 ft. center to center of piers, and this length is composed of a 300-ft. south cantilever arm, and 80-ft. north cantilever arm, and a 270-ft. central suspended span. The 300-ft. arm had, of course, to be made as heavy as though the span was to be 870 ft. instead of 650 ft., and the erection of this 300-ft. arm and of half the 270-ft. suspended span by projection will be the same operation as though the span was symmetrical and 870 ft. long, instead of unsymmetrical and 650 ft. long. There are two lines of pin-connected trusses 28 ft. center to center, the trusses having 30-ft. panels. The truss depth is 40 ft. at the end posts of the 600 ft. anchorage span, and 90 ft. over the middle channel pier. The clear headway at portals is 17 ft. 6 in. The central 270-ft. suspended span is level, but the long and short anchorage spans have grades of 3 per cent. and 6 per cent. respectively.



General Elevation of Marietta Bridge.



General Plan and Profile of Marietta Bridge and Approaches.

The width center to center of railings is 25 ft. 2 in., and includes a 4½-ft. sidewalk and a roadway, with a street railroad track at one side of the latter. The floor system consists of plate-girder floor beams between the truss posts, and three lines of I-beam stringers supporting sub-floor beams, spaced about 10 ft. between centers. Timber stringers carry the ties for the street railroad track while the joists for the roadway are laid on cushion timbers or bolsters upon the floor beams, so as to bring the planking flush with the tops of the rails. These are of T section 4⅝ in. high with wooden paving blocks next to the rails. The sidewalk is carried in a similar manner, and provision is made for building a sidewalk outside the trusses at some future time, and increasing the width of wagon way between trusses accordingly.

The approaches comprise two pin-connected through truss spans of 220 ft. each on the south side, and a plate girder viaduct 640 ft. in length on the north or Marietta side. The piers and abutments are of stone masonry; the channel piers rest upon piles, cut off to bed of river. Coffer dams were built around the piles and after excavating all loose material, concrete was rammed between and over the piles and the masonry built on top of the concrete. The substructure work has been done by the company by day labor, Mr. T. M. Ripley, Resident Engineer, and is practically completed now.

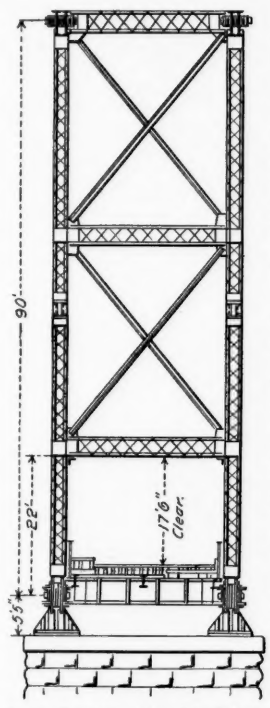
The assumed live load for the floor throughout and for the plate girders in the viaduct is 80 lbs. per sq. ft., or an eight-wheel electric car of 20 tons, or a steam road roller of 15 tons; for the trusses it is 60 lbs. per sq. ft. on roadway and sidewalk. Open-hearth, medium steel will be used, and the estimated weight of the super-

structure, including the two approach spans and viaduct, is 2,400 tons.

Foundation and Piers—By T. M. Ripley, Resident Engineer.

The bridge across the Ohio River, connecting Marietta, Ohio, with Williamstown, W. Va., will consist of five spans, two separate truss spans and three which form a cantilever, and a viaduct approach between abutments; also a graded approach from each abutment to the present street levels.

The north approach begins at the property line on the east side of Second street, and runs across the block to the westerly line of Third street. At this point it turns to the right 90 deg. 7 min. on a curve of about 60 ft. radius, and runs down Third street to pier 1, thence to the right, on an angle of 38 deg. 55 min. south, in a straight line across the Ohio River to Williamstown.

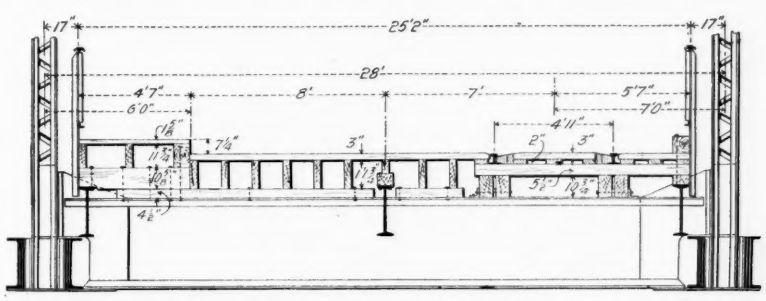


Cross Section (A)—Marietta Bridge.

The Ohio River from July to November is usually very low, showing but 2½ to 3 ft. above O on the Government gage at this place, but the "fall stage" frequently reaches 15 ft. and the spring rise often shows 40 ft. on the gage; last spring over 44 ft. was registered at this point.

The Marietta approach is filled and paved for about 180 ft. The abutment retaining walls and sidewalk are of concrete (also the pedestals for the viaduct between the alley and pier 1), and the roadway paved with brick. A stone curb is set along the sidewalk edge as any crowding from teams will be on that side, the street car tracks being as close to the opposite side as clearance will permit.

Pier 1 has a concrete foundation starting 10 ft. below the present street surface and built up in steps a height of 10 ft.; from there to the top, 47.55 ft. above the surface of street, the pier will be of range ashlar.



Cross Section of Floor System—Marietta Bridge.

Test borings were made on the site of pier 1 to a depth of 20 ft. with the following result, first 3 ft. clayey loam, remaining 17 ft. compact, clear, red clay.

The foundation is 17.5 ft. x 45.5 ft., which gives 726.25 sq. ft. of bearing surface; assuming the load to be 1,400 tons gives a pressure of 1.76 tons per sq. ft. This is an anchor pier with details for anchorage as shown by Mr. Strobel.

On November 2 an oak block, bearing surface 305.22 sq. in., with a platform about 3 ft. sq. nailed to it, was carefully loaded with 9,630 lbs. of pig iron. The weight of block and platform was 197 lbs.; total weight on bearing surface, 9,827 lbs. Weight per sq. in., 32.196 lbs.; weight per sq. ft., 4,636.22 lbs. Elevations were as follows:

Nov. 2, 9 a.m. Immediately after loading.....13.913
Nov. 2, 3:30 p.m.....13.912
Nov. 4, 8 a.m.....13.903
Nov. 5, 11 a.m.....13.910

The difference of one-hundredth shown on the 4th was undoubtedly due to the setting of the rod. There was a light rain on the morning of the 4th about 2 a.m., and at the time of taking the reading, the block was in ½ in. of water.

Piers 2, 3, 4 and 5 are similar in design, each having a pile-concrete foundation and built of range ashlar cut from the neighboring quarries, viz., Washington County sand stone.

The piles penetrate from 15 to 23 ft., driven under a specification of ½ in. penetration to a 20 ft. fall of a 2,000 lb. hammer. When the piles stopped with a less penetration than 20 ft. they were given from eight to 10 blows, after such stoppage before being pronounced "driven."

By far the greatest load on any foundation will be on that of pier 3. This foundation contains 180 piles with a total approximate load of 6,000 tons, or 33⅓ tons per pile.

Cofferdams were built around foundations 3 and 4 after the piles were driven, the water pumped out, piles cut off to bed of river, all loose gravel excavated (there was no sand or silt at these sites) and concrete rammed between the piles and placed over them in depths varying from 2 to 3 ft. On this foundation was begun the footing courses of range ashlar.

The load per pile, pier 3, is 33⅓ tons, assuming none of the weight carried by the gravel, but the actual condition is that the concrete as placed has a perfect bedding on the firm gravel bottom, between the piles and independently of the piling will sustain a load equal to the supporting power of said bottom.

The spread of the concrete under pier 3 is 27 ft. 8 in. x 61 ft. 11 in., which gives a total area of 1,712.7 sq. ft. Assuming each pile to be 14 in. in diameter, or 1.07 sq. ft., would give 1.07 x 180 = 192.60 sq. ft. Then 1,712.70 — 192.60 = 1,520.10 sq. ft., is the bearing surface on the gravel. This at four tons per square foot gives a bearing power of 6,080.4 tons, enough to support the load without the aid of the piles.

The foregoing applies to every pier with a pile foundation, and is the result of favorable conditions existing, viz., hard, firm gravel bottom precluding the necessity of deep foundation work, and little water to contend with from July to October or November. Piers No. 3 and 4 are rip rapped around the up-stream end and about half way along each side with stone in all sizes up to a cubic yard.

The abutment and retaining walls on the West Virginia shore will be of concrete. Coming on to the ground at the ends of two streets necessitates building a double approach.

The piers are range ashlar backed with large stone and concrete as follows, the backing stone are first bedded in mortar, being left far enough apart to permit of ramming between, then concrete is thoroughly rammed in the interstices until same is flush with the top of the course. Too close laying of the backing-stones would result in the defeat of the very end sought, viz., good work economically done, as the concrete could not be properly rammed without much delay or else the work would be porous and poor.

The ratio of the materials in the concrete is based on the materials and amount obtained from the 16-mesh sieve calling that which passed, clear sand, and that remaining on the sieve, clear gravel. The ratio is: 1, cement; 3, sand; 7½, gravel.

Two blocks of concrete (about 1 ft. cube) made from batches put into the work, after seven days were sunk in the river for 60 days and when taken out and boxes split off the concrete chipped, under blows from a sharp pick-axe, like medium hard stone.

The Alpha cement being used is very slow setting and it seems advisable that concrete made of it and intended to carry heavy loads be allowed to stand a considerable length of time before being loaded, say, from 10 to 20 days, and even a longer time, dependent on the volume of fresh concrete, load per sq. ft. and temperature and humidity of atmosphere. In making all tests I have had the co-operation of Mr. Geo. Adgate, M. Am. Soc. C. E., Superintendent, who put at my disposal all the men and tools possible.

The Block System on the Atchison in Colorado.

The Colorado Division of the Atchison, Topeka & Santa Fe, 120 miles long, from Denver southward to Pueblo, has now been operated under the block system for 15 months. About one-third of the stations are dependent entirely on telephone communication; and the arrangement has given marked satisfaction. The principal stations on the line were, of course, equipped with telegraphic communication before the block system was adopted. To make the block stations sufficiently near together to enable trains to be moved without delay a number of additional stations had to be established, and these new stations are communicated with by telephone. At least every alternate office is a telegraph office, from which telephone offices can obtain any desired information regarding the location of trains when such information is necessary.

The semaphore arms at each station are placed on a single post, one arm for each direction, and, as on other parts of the Atchison road, the caution or permissive indication is given by inclining the arm upward 45 deg. At stations where approaching trains do not have a good view, a distant signal is provided. The rules provide that where a card is used for a permissive movement (instead of using the permissive indication of the semaphore) the card must specify the train for which a lookout must be kept. All of the block signaling is done by telephone, although, as before stated, the telegraph can be used between the principal stations in case of necessity. The telephone circuits extend only from one station to the next adjoining station. Each station has a single telephone, but has separate call bells for the different directions.

Ordinarily, the despatcher does not receive reports of the departure of trains from non-telegraph stations. Eastbound trains (toward Denver) are permitted to enter a block unannounced (if the block is clear), but to send forward a westbound train a signalman must first communicate with the other end of the block. Permissive blocking is not allowed in ordinary service, except for freight trains on certain ascending grades.

The enginemen and trainmen warmly appreciate the benefits of the block system.

The stations on this line, reading northward from Pueblo, with the distances between block stations, are as below:

Pueblo U. D.	...	...	Palmer Lake	3.4	BT
Pueblo	0.0	BT	Spruce	3.0	B
Herrick	2.0	B	Greenland	2.6	BT
Bragdon	5.3	BT	Larkspur	3.2	BT
Pinon	5.0	BT	Tomah	5.5	B
Henkel	5.6	B	Castle Rock	5.0	BT
Buttes	5.0	BT	King	4.3	B
Hall	3.2	B	Sedalia	3.4	BT
Fountain	3.9	BT	Gann	3.2	B
Crews	3.3	B	Acequia	3.6	BT
Skinners	3.6	BT	Struby	2.4	B
Colo. Springs	5.9	BT	Littleton	4.6	BT
Johnson	3.5	BT	Military Post	2.0	B
Breed	4.5	BT	South Denver	4.5	BT
Husted	5.5	B	Denver	3.0	T
Pring	2.6	BT	Denver U. D.	...	...
Monument	3.1	BT			

Stations marked "B.T." have telegraph offices; at the others telephones are used. The number of trains over this line is about 60 a day, 30 each way.

Railroad Legislation in Massachusetts.

The Legislature of Massachusetts was finally adjourned on June 28. The most important railroad legislation was the renewal of the grade crossing appropriation. The law provides for the expenditure by the State of $5,000,000, to continue the work of eliminating grade crossings of railroads and highways, a like appropriation made in 1890 having been exhausted. The present law is similar to the old one; the expenditure of $500,000 annually, for 10 years, being the main feature. As under the former law, the railroad companies are to pay 65 per cent. of the cost of improvements of this kind, and the towns 10 per cent.; but the other 25 per cent., heretofore paid by the State, may now be assessed partly upon street railroad companies, in the case of crossings where there are street tracks. The street railroads must not be assessed more than 15 per cent. of the total. This new provision applies only to crossings for which the special commission of three experts has not yet been appointed. This relieves the street railroads in the important improvements now pending at New Bedford, Worcester, Fall River and Haverhill. The most important cities in which it is expected crossings will next be abolished are Lynn and Malden.

The Legislature passed a law making special provisions, in connection with the important work at and around the Union Station at Worcester. The special commission is authorized to discontinue the track now approaching the station from the north, and to provide for the entrance of the Boston & Maine trains to the station over the viaduct now used for transferring freight trains to the Boston & Albany.

One important measure passed (important because it becomes a precedent for legislation in future years) authorizes contracts for the operation, lease, or sale between, and the issue of stock or bonds by the Grafton & Upton Railroad, the Milford & Upton, the Milford & Uxbridge, and the Milford, Holliston & Framingham; and authorizes said companies to be common carriers of goods. The effect of this bill will be that the Grafton & Upton (steam) railroad company will purchase the stock of the others, all street railroads, and that the four roads will be worked as one system. The bill to permit railroad corporations generally to hold and vote upon the stock of street railroad companies met opposition and was referred to the next General Court.

A great deal of the time of the railroad committee was taken up in hearings in relation to 5 cent fares upon all railroads in the suburbs of Boston. At the same time, petitions were pending for an increase in the number of workingmen's trains. The committee finally reported, in place of the bill desired, a resolve for an investigation by the railroad commissioners of the whole question of railroad fares in and about Boston, and this was passed and approved.

A bill was passed permitting the railroad commissioners to employ experts in determining the value of railroad property. A bill was enacted to provide that railroad and railway inspectors employed by the railroad commission should receive salaries of $2,000 each instead of $1,500 as heretofore.

A determined effort was made to secure legislation for maximum fares of two cents a mile on all railroads, but it was rejected by the Senate. A bill to regulate the number of brakemen on freight trains and the length of cabooses, was rejected. After many long hearings, the Legislature repealed all legislation relative to a new bridge across the Connecticut River between Springfield and West Springfield, and the assumption is that when another Legislature comes in a petition will be filed for a bridge in a different location.

A bill was passed to authorize the town of Saugus to reconstruct the bridge over Saugus River; and one for the completion of Little's bridge, lying partly in Marshfield and partly in Scituate, the cost, not to exceed

$2,000, to be paid from the treasury of the Commonwealth. There was a petition for a new drawbridge between Fall River and Somerset near the site of the present Slade's Ferry bridge, but a resolve was passed for an investigation of the whole subject by the Bristol County Commissioners, the expense of the work of investigation not to exceed $5,000.

Early History of the Delaware, Lackawanna & Western Railroad and Its Locomotives.*

BY HERBERT T. WALKER.

PART VII.—TUNKHANNOCK TUNNEL COMPLETED.

This is all that need be recorded of the "Anthracite." It was not a success, but at the same time not by any means a failure, and the directors were so far impressed with its performance that they decided to follow the matter up, but before recording subsequent events in this connection, we must go back to the construction of the road, for in April, 1854, the tunnel through the Tunkhannock Mountain was completed and the event celebrated by an excursion upon the road given to the employees of the Company and their families and by an entertainment at Great Bend. This was a great relief to the train men to say nothing of the passengers, as the backing and switching over the hill was a tedious and laborious process.

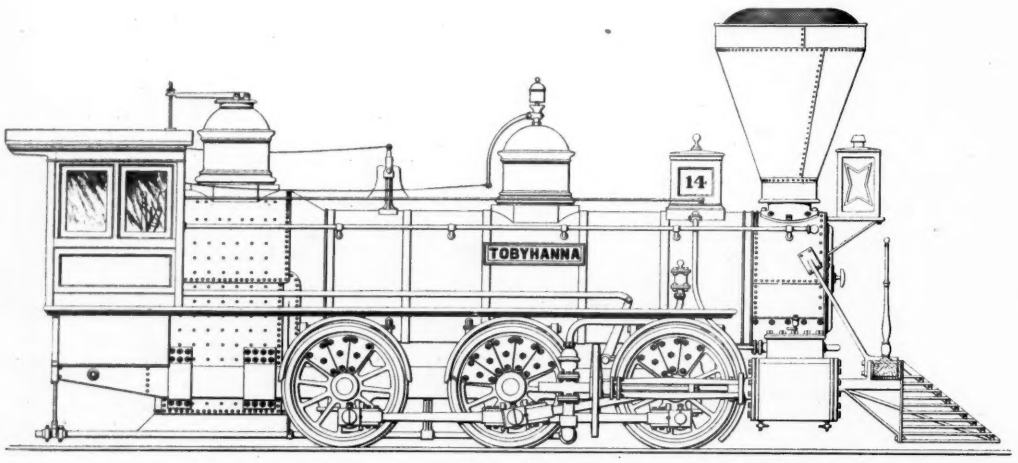


Fig. 17.—D., L. & W. R. R.—Colburn's Wood Burning Freight Engine, 1854.

Mr. John I. Blair was appointed land agent for procuring the right of way for the Southern Division, and good progress was made in this department under his astute leadership. The construction work also progressed more favorably as the spring opened up, and steam excavators were put to work in the heavy cuttings at Naglesville and Dughill.

It will be remembered that the charter of the Delaware and Cobbs Gap Railroad gave them the option of extending the road from the Water Gap to Belvidere to connect with the Belvidere & Delaware Railroad, which would have enabled the D., L. & W. R. R. to reach New York City via Trenton and the New Jersey Railroad & Transportation Co., but it was finally decided to join hands with the Warren Railroad of New Jersey, a line 18.80 miles long running from the Delaware River to New Hampton Junction and there connect with the Central Railroad of New Jersey, to New York. The Warren Railroad Company was chartered Feb. 12, 1851, and appears to have been under financial embarrassment from the beginning, for on Jan. 27, 1854, they entered into an agreement with the D., L. & W. R. R. Company and the C. R. R. of N. J. Company. This agreement stipulated that the Lackawanna Railroad should furnish a portion of the means for the construction of the Warren R. R. by subscribing $150,000 to its capital stock and by guaranteeing $300,000 of its bonds. The C. R. R. of N. J. Co. were to take $150,000 of stock, and guarantee in like manner $250,000 of its bonds, they agreeing to lay down a third rail on their track for the Lackawanna broad gage rolling stock. It was also agreed that the Lackawanna Company should receive a lease of the Warren Railroad when completed, and operate it as a part of their own line, paying as rent for the same the interest upon the cost of the road as represented by the stock and bonds issued.

When, as before noted, the directors determined to follow up the question of burning anthracite coal in their locomotives, it was thought advisable to engage a master mechanic, and so relieve Superintendent Dotterer, who had been acting in that capacity. At the invitation of President Phelps, and Director Moses Taylor, Watts Cooke accepted the position (1854) although he was only 22 years of age, and soon commenced the arduous duties inseparable from that office.

Meanwhile, orders for several engines, both wood and coal burners, had been given to various builders. As some of the latter were of the "Anthracite" type, Watts Cooke knew there was plenty of trouble ahead, and efforts were made to countermand the orders, but without success, as the Company were firmly bound by written contracts. The next engine to come on the road was the wood burner "Tobyhanna," shown in Fig. 17, which was purchased in September, 1854. Then came the coal burner, "Carbon," Fig. 18, designed and built by Ross Winans and purchased in October of the same year. After this, in February, 1855, the coal burner "Lehigh," illustrated in Figs. 19 and 20, made its appearance. As it is best to describe "Tobyhanna" and "Lehigh" later on, we will examine the "Carbon" first.

This engine (Fig. 18) was the second hard coal burner on the railroad and was of the standard Ross Winans make. It presents so many peculiar features, that we will dwell somewhat minutely upon it.

Ross Winans was a man of originality, and really designed some of the best hard coal burning engines of his time, recognizing the necessity of a large grate area for so refractory a fuel as anthracite. His shops were in Baltimore, adjoining the Mount Clare shops of the Baltimore & Ohio Railroad. He was a prolific inventor and generally patented his inventions, some 15 of them, all pertaining to locomotives appearing in the records of the Patent Office. His engines were generally lower priced than those of contemporary makers, and for this reason alone, he secured many orders and amassed a large fortune thereby.

Turning to the drawing, we find that the "Carbon" had an overhanging fire-box of no less than 7 ft. 4 in. in length, but it was within the track gage, and was therefore not "wide." The top sloped downward and was flat, as also was the crown sheet. This required a large number of staybolts and braces. There is no record of the width of the fire-box, but these engines had the reputation of being very free steamers. It has been reported that the inside fire-box was of copper. As there was much overhanging weight the fire-box may have been sloped at the top to make it lighter, and as this would lessen the steam room the large steam dome was doubtless provided, for we find that it was 42 in. in diameter. The engine weighed about 25 tons, and as this was distributed over eight driving wheels, it was easy on the track and at the same time of ample tractive power, the driving wheels being 43 in. diameter and the cylinders 19 in. diameter by 22 in. stroke. The wheels were cast-iron with chilled treads, and the coupling rods had solid ends.

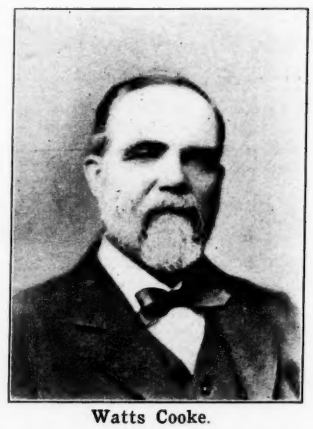
The drawbar was V shaped and riveted to the ash pan. The two arms of the V were bent upward and bolted to one of the plates of each frame, in front of the back driving axle. The apex of the V projected behind the fire-box, having an eye for the coupling pin which connected it to a single bar under the tender in a similar way to that on the "Anthracite." It may be mentioned in passing that the tender trucks consisted simply of springs uniting the journal boxes in pairs, said springs being connected together by heavy wrought iron bolsters on which the center plates rested.

The method of firing the "Carbon" was very peculiar, for as the grates were nearly 7 ft. long, it was supposed that the coal could not be properly distributed over them, so Winans provided two coal chutes on the top of the fire-box; at the base of these chutes there were sliding doors operated by long levers as shown. The tops of the chutes were covered by a hinged door and counterweight. In order to get coal up to this level the tender was provided with a raised platform immediately above the "pit" and high enough to enable the fireman to work below it. From this platform coal could be shoveled into the chutes, the sliding doors being first closed and the hinged door opened, then the coal was shoveled into the chutes and the top door closed, and lastly the sliding doors were opened, allowing the coal to fall on to the fire. This arrangement was not satisfactory and the chutes were soon removed, the firing being done in the usual way by the several fire-doors, the hinges of which can be seen on the drawing.

The grates were of cast-iron and each bar could be shaken independently of the others by inserting a shaking lever in the holes produced in the end of every grate bar which projected outside the fire-box. This was one of the cheapest forms of shaking grates ever used, and detail drawings of them are given in the *American Engineer* of June, 1898, page 205, which contains a good article on the Winans engines.

The stack had a quadrangular top provided with iron bars placed edgewise. These bars deflected the sparks into the cylindrical receptacle in front of the smoke-pipe, from whence they were removed by the door plainly shown on the drawing. The receptacle supported a bracket for the bell, which, with the sand-box, were put on by the railroad company, Winans not furnishing them.

The exhaust nozzle was variable, consisting, broadly, of a pyramidal box, rectangular in cross-section, having two loosely fitting cast-iron partitions which, by means of a worm, could be moved to or from each other, thus contracting or opening the blast orifice. This worm shaft was operated by two bevel gears and a vertical shaft, which came out of the smoke-box; this shaft was in turn worked by gearing and a crank handle in the cab as shown. This crank handle was derisively called the "coffee mill," the arrangement causing as much profanity as any other device giving trouble to engine men, for the pyramidal box soon got clogged with cinders and the partitions rendered immovable. It was, therefore, the practice to adjust them in the most effective position, and let them stay there. This design was protected by a patent granted to Winans April 10, 1847.



Watts Cooke.

The throttle lever was a curious and probably unique arrangement. A horizontal shaft, bracketted to the safety valve casing, had an eccentric mounted thereon, the strap of this eccentric being connected to the throttle valve stem. The shaft had two pendulous levers, one on each side of the eccentric, these levers having horizontal handles at their lower ends. The throttle valve was opened by swinging the levers upward, and any jar of the engine had a tendency to cause these levers to drop and thus close the valve.

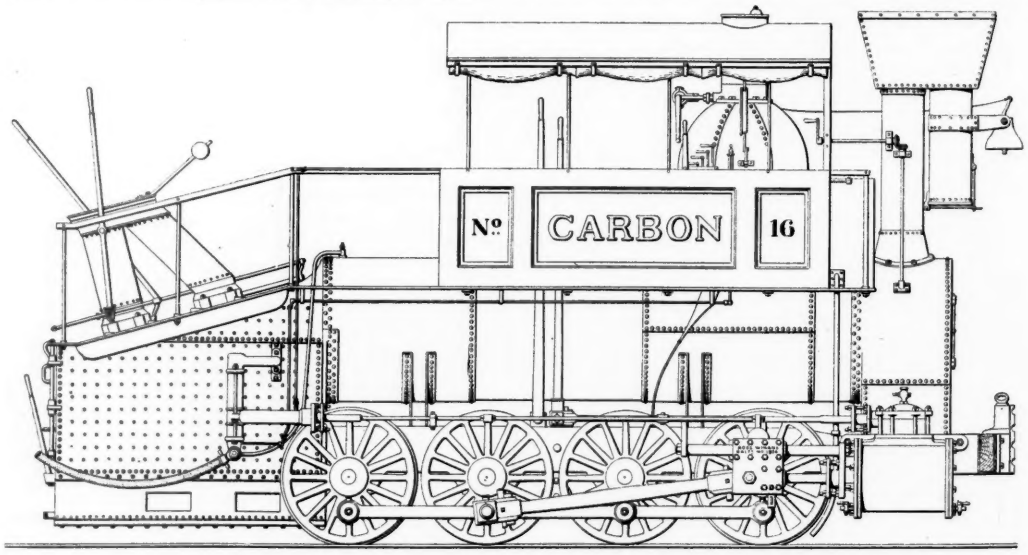


Fig. 18.—D., L. & W. R. R.—Second Hard Coal Burner, 1854.

The steam was worked by four eccentrics and two cams having drop D hooks, which were thrown into and out of gear by a series of cams called "half moons" mounted on a shaft immediately under the lower rocker arm. This shaft was turned by a pinion meshing with a rack connected to a long reversing lever that extended

*Copyright, 1902, by the *Railroad Gazette*.

up into the cab. The other lever (the shorter one) is the "starting bar," and was used to move the rockers and valves when the hooks were not in a position to fall into gear. Of course, this starting bar moved with the rocker arms, but they were made to fit into sockets and could be taken out when the engine was properly started. The upper and lower rocker arms were made

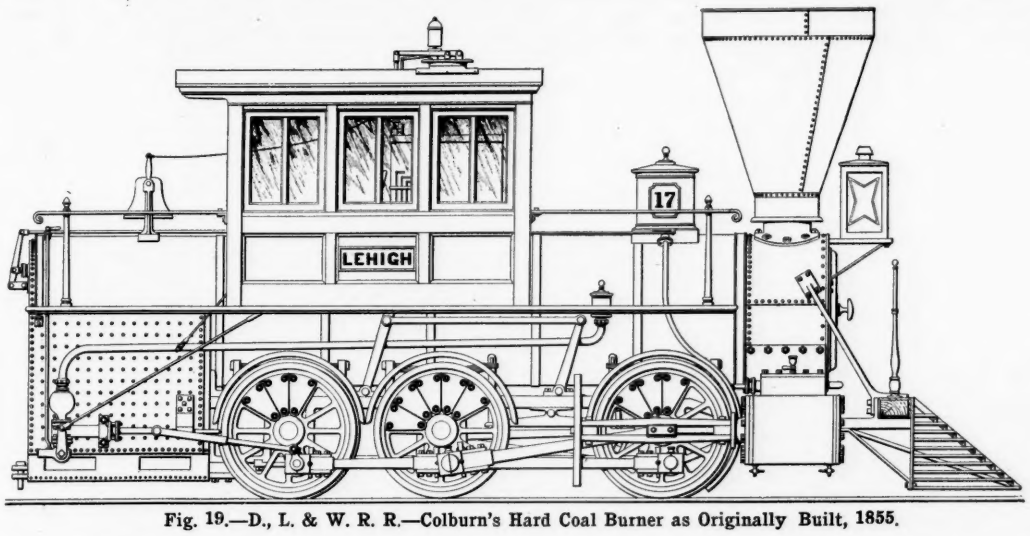


Fig. 19.—D., L. & W. R. R.—Colburn's Hard Coal Burner as Originally Built, 1855.

in one solid casting which ran freely on a rigid cross shaft fastened between the frames. In the drawing it will be observed that midway between the second and main driving wheels are four small circles. The first one, behind the pump rod, is the upper rocker pin; the second is the end of the rocker shaft; the third is the lower rocker pin, and the fourth the end of the half-moon shaft.

The two cams before mentioned cut off the steam at half stroke when the engine was in fore gear; when it was in back gear the engine could only be worked full stroke.

The gage cocks were below the running board, the handles extending up within reach of the engine driver, who had to judge of the height of water by the sound of the escaping steam and water. The cab had canvas curtains which are shown on the drawing as rolled up. The frames were of wrought-iron plates ⅝ in. thick, consisting of two plates about 5 in. apart and held together by bolts and thimbles. The frames stopped at the front of the fire-box. The pedestal jaws were faced with cast-iron shoes. The springs were between the double plate frames and were thus invisible, resting on the top of the driving boxes.

The pumps were bolted to the fire-box and the water was fed directly on the side sheets. This was a bad feature and was soon changed. The pump rod was very long, being fastened to the cross head, and for the reason that it was in the same horizontal plane as the valve rod it must not be confounded with the latter. This pump rod vibrated considerably, and the connection caused many breakages of cross heads and piston rods.

The boiler was made of plates about $^{5}/_{16}$ in. thick, the seams being single riveted. The joints at the base of the large steam dome were so poorly braced that explosions resulted on these engines, although none is recorded in the case of the "Carbon." The smoke-box was square at the lower part and was bolted to the frames and cylinders; these joints worked loose and gave trouble. The boiler also appears to have been fastened rigidly to the frames by angle irons.

The company subsequently bought five other "Camel" type engines of somewhat larger and improved design. They were named "Maryland," "Virginia," "Vermont," "Michigan" and "Connecticut," and all came on in the year 1856. Their weight was 70,000 lbs. each. The cylinders were fastened to the frames in an improved manner. The pumps were worked by a curved arm on the connecting rod and the wheels had slip tires. The fire-boxes were a little longer and better stayed than the "Carbon," and the total heating surface was about 1,000 sq. ft.

These engines were designed to haul heavy freight trains, and when limited to a speed of say 10 miles an hour, they all gave good results, but when they had to keep out of the way of passenger trains and run 15 or 20 miles an hour, they soon failed. The coupling rod bearings were only about 2¼ in. wide and wore rapidly. In the clear mountain air, the pounding of these rods, together with the rattle of the cut-off cams, could be heard for many miles. These engines were all scrapped in 1859.

Such is a brief description of these powerful and remarkable engines. A full account of them would fill several pages and cannot be given here.

We will now return to the engines "Tobyhanna" and "Lehigh," Figs. 17, 19 and 20. They are of interest as having been designed by the brilliant but unfortunate Zerah Colburn, who was one of the most noteworthy mechanical engineers of his time. He was a farmer's son, born at Saratoga, N. Y., in 1832, and at an early age showed a remarkable aptitude for mathematics. Watts Cooke was acquainted with him, and described him as a young man eager to take hold of new schemes, of considerable ingenuity and a good thinker. Colburn appears to have been of a restless and impulsive disposition, seldom remaining long in one place or holding to any one scheme in order to perfect it. Be that as it may, he was a man of great intellect, and in the line of engineering journalism was without a rival in this or any other country. His literary style and elegance of diction form the most enjoyable reading, and should be perused by our younger generation of engineers who, with all their college education, appear to have neither time nor desire to clothe their ideas in acceptable English. Probably Colburn's masterpiece (which he did not live to finish) was "Locomotive Engineering and Mechanism of Railways," London, 1871. He also, in conjunction with D. K. Clark, wrote a treatise entitled "Recent Practice in the Locomotive Engine," being a supplement to the well-known "Railway Machinery," by the latter eminent English engineer. Colburn also produced in partnership with Mr. Alexander L. Holley a work on "The Permanent Way and Coal-Burning Locomotives of European Railways," besides other text books of a like character. He was a prolific contributor to mechanical periodicals, many of which he founded or had some interest in. He was one of the editors of *The Engineer* and the founder of *Engineering*—both published in London.* Unfortunately he was a man of extremes, and the curse of intemperance unhinging his mind, he committed suicide at Belmont, Mass., in 1870.

In 1854 Colburn was engineer of the New Jersey Locomotive Company at Paterson, and designed several wood and coal burning engines, one of the former class being the "Tobyhanna." This engine had plate frames 12 in. deep by 2 in. thick, the pedestals being solid therewith. The braces under the pedestals were held in place by tap bolts and were troublesome to keep tight. This frame when put together weighed three tons. The cylinders were bolted to the frames and were 18 in. diameter by 24 in. stroke. The weight of each cylinder in the rough was 2,175 lbs. The weight of the engine loaded was 68,100 lbs. The tube surface was 1,203 sq. ft., and the fire-grate area 19 sq. ft. The wheels were 48 in. diameter and the wheel base measured 11 ft. There was no truck, but the overhanging fire-box not being excessive the engine tracked well up to 20 miles an hour.

The late Benjamin S. Watson (familiarly known as "Uncle Ben") was one of the oldest engine drivers on the Lackawanna Railroad, and informed the writer that he ran this locomotive between Stroudsburg and Pocono Summit and found it a satisfactory engine for work. Mr. Watson died at East Stroudsburg Dec. 11, 1898, having served the railroad for over 42 years. He was one of the first men to run the celebrated English engine "John Bull," built in 1831, and exhibited at the Chicago Exposition of 1893.

The "Tobyhanna" came to an end by exploding in the "Notch," near Scranton, in 1870.

We have now arrived at the end of the year 1854; when the first engine report of the Lackawanna Railroad was published. The appended copy will be of interest, as it shows the mileage and cost of repairs of the engines previously described.

(To be Continued.)

*A memoir of Colburn will be found in *Engineering* of May 20, 1870, p. 361.

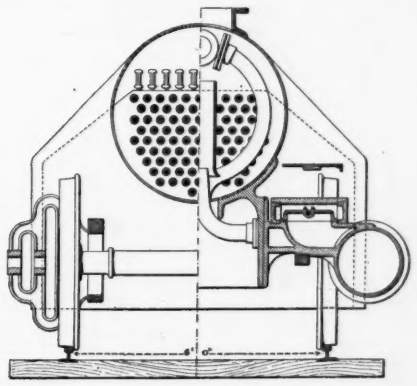


Fig. 20.—D., L. & W. R. R.—Cross Section of "Lehigh," 1855.

LIST OF LOCOMOTIVE ENGINES OWNED BY THE DELAWARE, LACKAWANNA & WESTERN RAILROAD CO. DECEMBER 31, 1854

Name.	Class.	Makers.	Time on the road. Years.	Mos.	No. of miles run in 1854.	Cost of repairs, 1854.	Cost per mile run, cents.	Remarks.
Pioneer	4th	Unknown.	3	6	.....	$66.95	....	Worthless.
Spitfire	4th	English.	3	0	9,650	1,088.03	11.28	In service. Wants new wheels.
Wyoming	2d	Rogers, Ketchum & G.	3	3	20,185	1,520.10	7.53	In service. Boiler, cross-heads and slides need repairs.
Capouse	1st	Rogers, Ketchum & G.	3	3	10,382	1,681.61	16.19	In service. In good order.
Montrose	2d	Rogers, Ketchum & G.	3	2	22,020	1,706.61	7.75	In service. In good order.
Ithaca	2d	Rogers, Ketchum & G.	3	1	16,752	1,791.11	10.69	In service. Flues want repair and new links.
Keystone	1st	Wm. Swinburne.	2	9	7,975	1,132.90	14.20	Under repairs. New tire and flues spliced.
Niagara	1st	Rogers, Ketchum & G.	2	6	15,363	599.56	3.90	In service. Wants tire turned.
Ontario	1st	Rogers, Ketchum & G.	2	6	13,817	1,364.42	9.88	Under repairs. Broken cylinder.
Genesee	1st	Rogers, Ketchum & G.	2	5	20,417	965.17	4.73	In service. Wants tire turned.
Buffalo	1st	Rogers, Ketchum & G.	2	5	20,776	1,638.18	7.88	In service. In good order.
Wyalusing	1st	Danforth, Cooke & Co.	1	7	17,697	1,668.36	9.42	Under repairs, receiving new tire.
Pocono	1st	Danforth, Cooke & Co.	1	3	18,818	570.51	3.00	Under repairs, cylinder broken.
Anthracite*	1st	Danforth, Cooke & Co.	..	7	7,985	1,012.27	12.67	In service. In good order.
Moosic	2d	N. J. Loco. Wks.	..	6	8,785	131.20	1.50	In service. In good order.
Lackawanna	1st	Danforth, Cooke & Co.	..	5	11,008	127.85	1.16	In service. In good order.
Susquehanna	1st	Danforth, Cooke & Co.	..	4	6,265	141.31	3.26	In service. In good order.
Tobyhanna	1st	N. J. Loco. Wks.	..	3	2,025	147.22	7.27	In service. In good order.
Carbon*	1st	Ross Winans.	..	3	1,525	533.11	34.95	Under repairs from collision with coal cars.
					231,445	$17,886.47	7.72†	

*Coal burners. †Average.

Roundhouse Air-Brake Work—Inspection and Repairs.

A report on this subject, presented at the convention of the Air-Brake Association in Pittsburgh, Pa., was published in the *Railroad Gazette* of May 9. Extracts from the discussion of the report at that meeting are given below:

Mr. J. E. Goodman (Northern Pacific)—I rather think that we are expecting a little too much from engineers nowadays. We ask the engineer to be familiar with the construction, operation and defects of the entire brake apparatus. However, where anything goes wrong with any part of the apparatus the engineer should be in position to know what it is and to make an intelligent report.

Mr. Foster (New York Central)—In regard to the repairing done in the engine house we can educate our repairmen a little more. If they were better educated they could make a test in a few minutes instead of tearing a pump to pieces, using three hours.

Mr. Greenwade—We have trouble with engineers being unable to make intelligent report on pump stoppages. Will some of the members tell how one may know why the pump has stopped?

Mr. L. M. Carlton (C. & N. W.)—There are three principal causes for a pump stopping. One is insufficient oil; another is the reversing plate getting loose and bending the piston; and the third is the lower main piston nuts getting loose. We instruct our men to shut off and open up again. If the pump makes a revolution and stops, as a rule you have one of two things, reverse plate loose or loose nuts on lower piston. Sometimes pouring oil into the cylinder will start the pump with good results. We find that one the small end of the main valve of the 9½-in. pump the rings get worn to such an extent that they leak enough steam to fill up the cavity on the small end, and that is why a report should

be had from the engineer when the pump stops frequently. This is a common cause of pump stoppage and by renewing the rings or rebushing we get good results.

Mr. Weaver (L. S. & M. S.)—An intelligent report of enginemen as to proper repairs, would be of great assistance to repairmen in locating defects. A good many times an engine comes in and possibly it is blown off before the repairman has a chance to get to it. There is no steam to make a test and he has to act largely upon what the engineman says is the cause of the failure or defect. It has been my experience that a good many times after taking the different parts apart, we find there is no trouble at all.

Mr. Sherman (C. S. & H.)—I believe in instructing the engineers on all defects, but when we come down to requiring the engineer to repair these defects in a roundhouse it is a little too much. If they will only give the symptoms of the disease for the repairmen in the roundhouse, it is as much as we can expect from the engineers.

Mr. Goodman—In regard to bent reversing valve stems, they are often bent when removed. Our practice is to remove them before taking the head off and then put the stem back afterwards. The second defect mentioned in the report: Air pump runs fast enough but does not accumulate enough air, is due to some defect in the air cylinder or leakage from the main reservoir into the main cylinder. In that case we instruct our men how to make a test to distinguish leakage by the piston, so that we can make intelligent report. In many cases we get a steam cylinder that blows, but the air cyclinder is in good condition so that the efficiency of the pump is not impaired.

Mr. Burton (Cent. of N. J.)—The committee recommends lubricating brake cylinders at least once in six months. That would depend very largely upon the location of the cylinders. We have some located near the fire-box that would hardly run six days.

I would like to have expression from some of the members as to the practice of reboring the pump cylinder on air end. Some roads rebore the cylinder ⅛ in. larger and put in a new piston, and when it leaks a second time they put on a new cylinder. Other air-brake inspectors believe in cleaning the cylinder out and putting in new piston packing rings. When it requires to be rebored again, they do the same thing, and in a year they have as many different sized pistons as air pumps. Rebore twice; that will frequently save stretching the cylinder. About 75 per cent. of the pump failures are due to bad packing rings. If the packing rings are very bad and allow the pump to pound the nuts get loose.

Mr. Forney (Sou. Pac.)—The better method of following up defects, which I have found economical in the long run, is to have the engineer met by a proper inspector at end of the line, and if he has had any trouble with the pumps have the inspector test the engine thoroughly in all details while coaled up. The engineer can make his report to the inspector and the latter will follow up that report, diagnosing the case. Then the repairmen can make repairs indicated. The first consideration is to pay your man a good salary. You cannot get competent air-brake men unless you are willing to pay them and they have to be men who have had considerable experience in shop and road experience. Shop men will do very well as inspectors, but road men with shop experience will do a great deal better.

Mr. E. G. Desoe (Boston & Albany)—The remarks made seem to imply that the duties of the engineer have so increased that the air-brake is now a second consideration, because his other duties have increased. I think the air-brake should be the first consideration, not a second, and all engineers should be educated so that they can report defects intelligently.

Mr. Mider (P. C. C. & St. L.)—The members seem to be losing sight of the fact that there are some roads where there are no inspectors, therefore the repairs depend to a great extent on the man in charge of the engine. When an engineer gets to the end of his trip, there is no person that ought to be as familiar with conditions as he, therefore he should be the best inspector that there can be. An inspector has to depend to a great extent on the man who is running the engine. This Association should endorse the report in regard to having the work reported intelligently by those operating the engines. It is absolutely necessary to take young men in hand and educate them up to the time that they are enginemen.

Mr. Libbey (L. S. & M. S.)—In regard to boring air cylinders of the pumps, we bore them but once and increase the size ⅛ in. We find that most air-pumps bored 1/16 in. will not make a good job. We bore ⅛ in. and when they require boring a second time, we throw them away and replace with new ones.

Mr. Budig—It has been my observation that pumps will give sign of defects before stopping. Why would it not be better before the engine starts out to have the inspector see that the pump is in good working order and then it will be all right going over the road. While it is well not to put too much work on the engineer, I think he should know all about the air-pump and valves. In the pooling system the engineman comes around a very short time before leaving time and starts the air-pump in a hurry. We all know the effect of that. If the pump is started and oiled and left in good condition, the engineer's duty would be lessened a good deal.

Mr. Kelley—The man who makes air-brake repairs should be a man who does not do anything else, and when you put responsibility on the engineer to look after all these defects, you are asking too much. The rule now is to get the engine out and find out the defects afterwards. The man who makes air-brake repairs should know if they are made right. We should simply tell the engineer what to do on the road; he is not supposed to take the pump apart on the road.

The President—On the road that I represent, we "chain gang" all our engines; we "chain gang" all our engineers' valves, brake valves, governors, air pumps, and any part of apparatus on the engine. We do not allow engineers near the shop. They get off two miles from the yard. The hostler brings the engine in and reports to the roundhouse. If a report should state that the air pump stops frequently, the pump comes off, another is substituted, and the old pump goes to repair room. If he reports brake-valve working hard the brake-valve comes off and he gets another. With all other parts of apparatus we do likewise, but when an engine leaves the roundhouse the inspector goes on that engine. He tests every part of the brake to see that it is in good working order. We do not have any failures, comparatively speaking, on that line of road, and if you "chain gang" your brake apparatus you will help the trouble a great deal.

Mr. Daly (Wis. Central)—In regard to educating the men on the technical part of the apparatus, I believe this should be done. For the last two seasons we have taken that up and I find that we are getting better results and we get better reports from the engineers. We bore our cylinder the second time 7 9/16 in., and we also bore them to 7⅝ in., but never unless we put a new piston in.

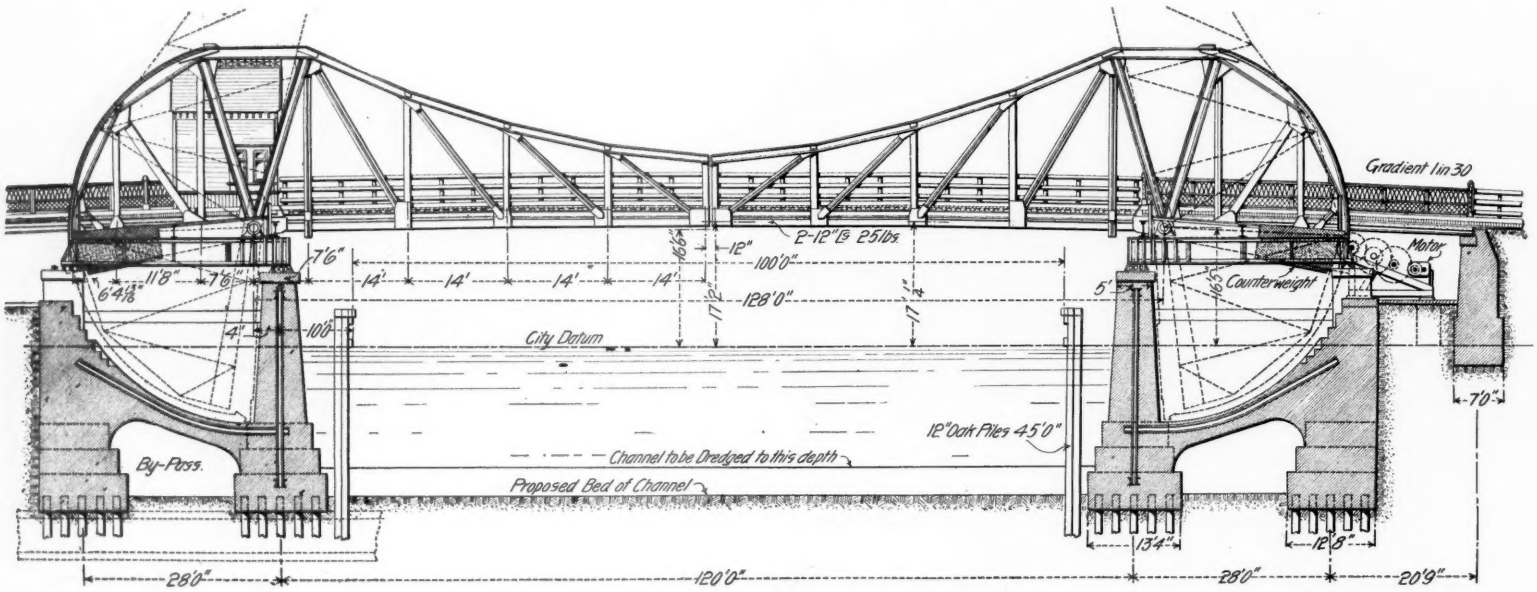
Mr. Waters (Mexico)—We have certain rules that engineers are required to follow in their reports. They are required to locate minor troubles that are easily located, such as broken piston heads, nuts coming off, etc. We have an examiner or inspector who tests the air-brake apparatus throughout. We have an air-brake pipe running through the engine house and usually have 100 lbs. of air which is coupled up to pump and the pump is worked up to the train line pressure of 70 lbs. This is done with every engine at least every 10 days at the general shop. It is done when the engine arrives in the engine house and gives ample time for repairs. They are inspected before they go out also, to see that everything is all right before leaving the terminal point. While we do not wish to overload the engineers, we find it is very essential for them to understand how to locate defects in engineer's valve and the pump. When they are employed they are examined as to their knowledge. If they pass 60 per cent. they are employed and instructed on points where they are weak. When a pump failure is reported the pump should be taken off. We have pumps running as long as two years without any failure whatever, making an average of 4,000 miles in freight service, and that is a good average for a pump. It is due to the lubrication the pump gets, and attention and inspection.

Mr. Brown (B. & O.)—I think that six months is enough for an air pump. The first time that a report comes that a pump is not all right, the pump should be sent to the back shop. The brake valves should be oiled and cleaned every four months.

A Trunnion Bascule Bridge.

The Clybourn Place bridge, opened to traffic in Chicago on May 24, is a type of bascule bridge new to America. The design was prepared by the engineering department of the city with a view to its adoption for all bascule bridges that the city will have occasion to install in the future. Before preparing the design a committee, appointed to submit plans, made a careful study of the information on movable bridges in the United States and Europe and decided on the trunnion bascule type as more fully meeting the requirements from a scientific, economical and practical standpoint than any other available type.

Briefly described the bridge is a fixed-center, double-leaf, counter-balanced, bascule, 128 ft. long c. to c. of pivot bearings, and 120 ft. c. to c. of piers, with a clear channel of 100 ft. between the pile protection works. Each leaf has three through trusses operated by racks on their curved tail ends, the latter descending into pockets or tail pits in the abutments when the bridge is open. The total width of the bridge



The Clybourn Place Trunnion Bascule Bridge, Chicago.

is 60 ft., the trusses being 21 ft. c. to c., and the sidewalks being carried on 9-ft. cantilever brackets. The clear headway above normal water level is 16 ft. 6 in. at the center.

The substructure, the form of which may be seen in the illustration, is built of concrete, above oak piling spaced 30 in. c. to c. and driven to bedrock. The concrete construction is reinforced by a steel framework. Under each tail pit a by-pass provides additional waterway. As already mentioned the superstructure is composed of two pivoted leaves each having three through trusses, 21 ft. c. to c. of chords at the outer end and 24 ft. 6 in. over the pivot pins. The tail ends, or heels, have a curvature-radius of 26 ft. 4 in. and carry the operating racks. Each truss revolves upon a trunnion having two bearings 15 in. in diameter and 26 in. long.

The location of the operating machinery is shown under the approach roadway. The motive power is two 38-h.p., General Electric, direct-current, railroad type motors each of which drives a train of gearing, operating the leaves through a pinion which engages the curved rack on the heel of each truss. The machinery is so designed that the opening of the bridge from the moment it is closed to traffic to when the leaves reach their highest position will require not more than one minute in calm weather, and not more than two and one-half minutes with a 70-mile wind blowing in an unfavorable direction.

The cost of the bridge was $155,000, of which $69,000 was for the substructure and $86,000 for the superstructure, which latter was built by the American Bridge Co. The work of designing and building the bridge was under the supervision of Mr. John Ericson, City Engineer. The design was prepared by Mr. Edward Wilmann, former City Bridge Engineer, and the work has been completed under his successor, Mr. Thomas G. Pihlfeldt.

Modern Water Supply for Locomotives.*

BY F. M. WHYTE.

The paper must be much like a report with the end in view of showing the present "state of the art." This explanation is due to the reader in order that he may know what value to attach to the paper as a whole, as well as to the few opinions of the writer which may be expressed.

Sources of Water Supply.—It requires extremely good judgment to decide what expense necessary to get a supply of good water can be met by the reduction in the cost of keeping boilers in condition.

The principal considerations concerning the source of supply are to get the best water possible for the allowable expense, and to get it in amply large quantities.

Power for Pumping.—There is provided in various ways the power to deliver the water; the most acceptable way is that of gravitation. At the ideal water-supply station the water is delivered from the source to the locomotive tank by gravitation. In so far as maintenance of machinery and handling of the same is concerned the equivalent to a railroad of the gravity supply is to purchase water from another corporation which does the pumping, usually towns and cities. Generally, however, the railroad does its own pumping.

Probably the cheapest power that can be used for the purpose is wind power; but it is necessary to have each plant thoroughly reliable, so that the tendency now is to supplement the wind power with other more controllable power.

Pumps which are steam driven are most generally used, and give much satisfaction where the water is obtained within a reasonable distance below the surface of the ground and the demand for water is large and constant. There is experienced, frequently, much annoyance with deep well pumps because of the difficulty of getting at the pumps. Quite generally the pumping plant for a locomotive water station is so small that only the simplest arrangements are provided; the number of boilers is seldom greater than one or two, and because one man can attend this number and the services of one man are needed, labor-saving devices are not needed in the average steam plant.

The exhaust from the steam pump should be connected to the suction pipe at some distance from the pump, the steam being directed toward the pump. This arrangement will assist the suction, reduce the back pressure on the steam end of the pump, and raise the temperature of the water, all of which are desirable results. Those who have used the arrangement give caution that care must be exercised to keep the exhaust pipes free from leaks.

The internal-combustion engine, in the form of gas or gasoline engine, is being used more and more for providing power for pumping, and there are conditions which can be fulfilled very nicely with this kind of power. Where the work is intermittent, or can be made so, and the attendant is employed to advantage elsewhere when not attending the pumps, these engines have been used with much satisfaction. The gas engine or gasoline engine pump-house should be thoroughly ventilated at all times. It is the general practice to use gasoline in these engines, but quite recently it has been found that hydrocarbon, a by-product of the Pintsch gas plants, can be used in these engines, and when this hydro-carbon is available there may be a material reduction in the cost of operating the engine. If a road is supplying its own engines from its own gas plants a very convenient way for handling the liquid is to provide metal casks of a capacity of about 50 gal.; or a sufficient number of tank cars may be provided, the cars to be sent out over the line, the oil tank at the pump-house filled, and the tank car moved on to the next station. These engines may be handled in such a way as to be extremely economical from the standpoint of labor costs; they can be so arranged that the only labor shall be that of starting the engine, it being cut off automatically when the water tank is filled.

Compressed air is used for raising water. The requirements for such a system are an air compressor, and some means of driving it; frequently the compressor is run by a gasoline engine, and the two may be made very compact. Compressed air gives a very convenient means of raising water from deep-driven wells, because the operating machinery is all above ground and the pipes, if they are found out of order, are easily and quickly replaced. Another condition which justifies the use of compressed air is the necessity of using a number of wells to provide the necessary quantity of water, allowing the water from the various wells to flow either to the place where needed, or to flow to the suction of force pumps. The air-lift will not deliver the water horizontally to any great distance, so that when the lift, or well, is at a greater distance than 40 ft. from the place where the water is to be used it is necessary to raise the water perpendicularly at the well to such a height that it will be delivered by gravitation to the place desired, or to provide other means for the horizontal delivery. This means of pumping can be also used to advantage when it is desired to locate the pumping machinery at some distance from the well.

A very interesting example of the use of compressed air is shown in Fig. 1, which shows the details of the water system at the Denver shops of the Colorado & Southern Railway.

Information concerning the proper proportioning of air-lifts has been the result of experience obtained by those who are engaged in making air compressors and in designing air-lifts, and the formulæ which have been deduced from experience are treasured highly and are not available for publication. The general practice is, however, to make the relation of the submersion to the lift from 4 to 3, to 3 to 2. This is the "working" submergence as distinguished from the height at which the water stands in the well before pumping is begun. If a lower percentage of submergence is used the cost of operation is increased. The weight of the column of water above the air inlet is readily calculated, and this will equal the pressure at which the air must be delivered to the point where the air and water are mixed. The starting pressure will be greater than the working pressure. The working pressure, divided by the atmospheric pressure at the altitude of the well, will give a quotient to which, if unity is added, will give the number of volumes of free air required. The capacity of the well may be calculated by allowing 15 gal. per sq. in. of cross section of pipe per minute, or by taking the rate of flow in the discharge pipe at 5 ft. per second. For heights of from 15 to 50 ft. there will be required 2 to 3 cu. ft. of air at atmospheric pressure per cu. ft. of water delivered; for heights of from 50 to 100 ft. it is considered best to provide 3 to 4 cu. ft. of free air at atmospheric pressure for each cu. ft. of water delivered. The maximum efficiency of this system of pumping is about 50 per cent., and may be as low as 15 to 20 per cent.

The water is not raised usually by air pressure; the air mixes with water in the delivery pipe, making the weight of the column of water and air in the pipe less than the weight of the column of water outside of the pipe. Sufficient air must be mixed with the water to make the difference in weight of the column inside the delivery pipe and the one outside of it such that they balance each other when the column inside the pipe

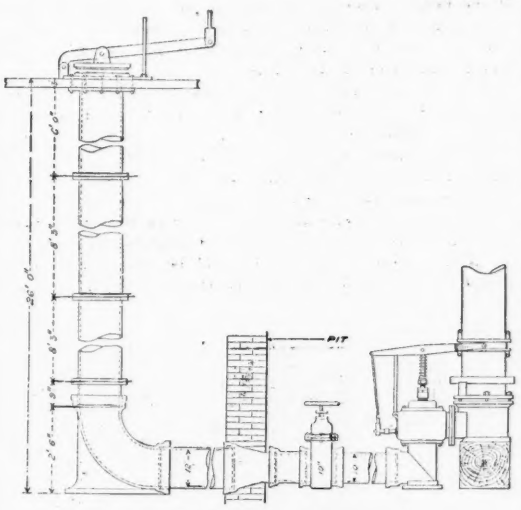


Fig. 1.—Ideal Piping Arrangement.

stands at a height slightly in excess of the height to which it is desired to raise the water. If more than the required amount of air is forced into the delivery pipe the cost of raising the water will be needlessly high. The water may be forced to a considerable height by increasing the air pressure, but the expense in so doing becomes excessive.

Other means than those mentioned in the foregoing are used for pumping water for locomotive supply, but the above are referred to at greater length because they are used most universally. Water power, transformed in various ways, is sometimes used. Electricity has not been used to any great extent, but no doubt it will be used in the future much more than it is at present. Pumps driven by electric motors can be made automatic for both starting and stopping, so that the only attention necessary is for oiling and inspection. These pumps will be used where the electricity is available from supply furnished for other purposes, and where the amount used for pumping is a small portion of the total electrical power developed.

Reservoir Tanks.—Sometimes the water is allowed to flow direct from the reservoir tank to the tank of the locomotive, and then, of course, the reservoir tank is placed close to the track. This provision for delivering direct from the reservoir to the locomotive tank is not considered desirable, and in America, at least, new reservoir tanks are set back from the track, and the water is delivered to the locomotive tank through a water crane. There are several reasons for such a change; the reservoir tank is an unwieldy structure to handle in case of changes in track; and very serious accidents are possible if, from any cause, the tank falls.

The kind of material of which these reservoir tanks should be constructed is not so closely defined now as it was a few years ago. There are being built quite a number of steel tanks on steel substructure, and a few similar ones have been in use for several years; the indications are that the present time may be called a transition period, and that steel will be more generally used for these structures than it is at present.

The accepted construction for the frost-proof box is to enclose with sheathing the space within the four middle columns, there being three or four courses of sheathing, with air space three or four inches wide, between each course, and a lining of building paper on each course of boards. The extent of this protection will depend, of course, upon the climatic conditions which are to be met. It is considered very bad practice to fill with sawdust or shavings the space between the sheathings. Further protection against freezing is sometimes provided by enclosing the whole substructure and placing a stove inside, the pipe from which will be placed beside the water-pipes. The stove-pipe is sometimes extended up through the tank, a suitable cast-iron pipe being used. If the inlet pipe discharges above the highest water level in the tank, provision can be made to drain this pipe as soon as the delivery is stopped, but with this arrangement the pump must be worked always against the maximum head.

A very usual capacity for these tanks is approximately 50,000 gal., obtained by making the tank 24 ft. diameter inside and 16 ft. high. Some tanks of larger capacity, 100,000 gals., are used. The tank is sometimes made rectangular, but this form may be considered rather the unusual. The Philadelphia & Reading has in use a number of rectangular tanks supported on stone foundations. These tanks were built years ago.

The difficulty experienced in getting good timber, the increasing cost of good timber, and the increasing tendency among railroad officials to make all structures of a more permanent nature, have contributed to the selection of some material instead of wood to be used in the construction of tanks and supports. The substitution may take the form of steel tanks supported upon a trestle of rolled steel shapes, supported upon stone substructure, or the steel tank may be continuous from the foundation at the ground level to the top. Tanks which are made of steel and which are supported upon a substructure made of rolled-steel sections, are generally made with a semi-spherical bottom, this shape being used because it is self-supporting between the columns. Those persons who have had experience with steel tanks speak very favorably of them. It is supposed that some difficulty will be experienced in painting the interior surface of these tanks, but it has not been demonstrated yet that such painting will be necessary.

A water tank has been constructed of vitrified tile, held together by steel hoops, the hoops being enclosed in the tile; this tank was supported at the usual height on tile foundation. There is being constructed another tile tank which will be continuous from the ground level up.

Cement construction is offered for tanks; steel rods being placed in the cement on the sides and roof and in the substructure to add to the rigidity. Tanks of this construction are offered of from 20,000 gals. to 100,000 gals. capacity.

The desire now is to deliver the water to the locomotive tank as quickly as possible, and as the rate of flow depends upon the velocity and the size of the stream, we are not confined to increasing the velocity, by raising the head, in order to increase the rate of delivery. It is much better to increase the size of pipe connecting to the water crane, and place the reservoir tank at an average height of 20 ft. or less. The lower the tank the less the head against which the pumps must be worked, and as the cost of pumping varies almost in proportion to the delivery head, the importance of having the tanks low will be appreciated.

It is conceded quite generally that the capacity of pumps and of tanks commonly used heretofore have been too small to allow of most economical operation, and the effort is now to provide ample capacity for pump and tank so that continuous pumping will not be necessary.

Water Cranes.—The present rush of both passenger and freight business makes necessary the saving of every minute possible, and more attention is being given to means for delivering quickly the water to the locomotive tank; with the object of delivering the water as promptly as possible, the pipe from the reservoir tank to standpipe is made larger in diameter than was commonly the practice; the crane, or standpipe, is made larger; and the valve is made with a more direct passage for the water. In fact, a serious study is being made of the friction of water in pipes, valves and bends, and as a result some previous designs are being revised or discarded. It will be appropriate to give here the results of some tests made by Mr. T. W. Snow. A 90-deg. bend of a radius equal to one and one-half times the diameter of the pipe, for pipes 8 to 14 in. in diameter, offers a resistance to the flow of water equal to that of 100 ft. of straight pipe; a 12-in. pipe, 300 ft. long and having three bends of 90 deg. each, the head being 24 ft., gave a flow of 4,000 gal. a minute; under the same conditions, except that the length of the pipe was 900 ft., the flow was 3,200 gal. a minute. With an improved standpipe, the flow under conditions similar to the first instance given above was increased to 5,000 gal. a minute. These data will impress the necessity of having direct passages. The pipe connecting the reservoir tank and the crane should be larger than the crane; one size larger seems to be in accordance with improved practice, and the change in diameter is made just outside of the crane pit, or as close to the valve as possible. Some device should be provided to protect the pipe and the valve against shock due to sudden closing of the valve. It should be possible for a person to operate the crane while standing on the ground and also while standing on top of a tender. The standpipe, for cold climates, should be drained automatically when the controlling valve is

*Extracts from a special paper by F. M. Whyte, Mechanical Engineer New York Central & Hudson River Railroad, presented at the Annual Convention of the Master Mechanics' Association.

closed. The arm should have considerable motion in a vertical plane. It should be positively locked in the position parallel to the track, so that it cannot be blown by the wind, or placed accidentally into the position to foul trains. Drainage must be provided for the crane pit. For proper security a gate valve should be placed inside of the crane valve, and there should be another valve near the reservoir tank. The piping arrangement shown in Fig. 1 has been prepared by the Otto Gas Engine Works, and is presented as an ideal. The pipe should be given a coat of asphaltum inside, to reduce friction; and the velocity head may be reduced by making the inlet in the shape of a funnel.

The tendency is toward cranes of larger diameters, 10 in. and 12 in. in diameter, and the pipes leading to them are respectively 12 and 14 in. in diameter. The height of the outlet of the crane above top of rail is controlled by the height of locomotive tank.

It may not be out of place here to refer to what appears to have been an oversight in planning the water-supply systems of the railroads in America, at least. It seems, sometimes, that the idea has been that a water tank or column in sight is as good as one at hand, and as a result locomotives are delayed near water stations until other locomotives are supplied with water. Large switching yards are provided with one or two cranes, usually near a short ash-pit, and several times a day a line of locomotives may be seen near the water station, the crews waiting their turns. There must be done just so much work and just so much water must be used to do it, and it is cheaper to deliver the water in pipes to the locomotives than to run the locomotives to the water station if the stations are not conveniently located. With the cranes conveniently located in a switching yard, the locomotive tanks need not be of extreme capacity; and it is expensive to switch water backward and forward. The saving in cost of pipe and cranes is a false economy.

[The author here gives descriptions of cranes in general use in England, the current practice being in favor of a brass bushed valve placed in the bottom of the column, and operated by means of hand wheel and bevel gears, either from the locomotive or from the ground.—Editor.]

Track Tanks.—Track tanks are made 6 or 7 in. deep and 18 to 20 in. wide; they are placed central between the rails of a track. The top of the tank, or, more particularly, the level of the water in the trough, must bear a fixed relation to the top of the rail. In America it is general practice to support the tanks directly on the cross-ties, the cross-ties being cut out to a depth equal to the difference in depth of the track rail and the tank; in other words, the top of the tank is placed generally at the same elevation as the top of rail. In England the tank is supported, usually, upon wooden stringers, which rest on the cross-ties. The tanks are of various lengths; some are 1,200 ft. long, others 1,400 ft. long, and others are 1,600 ft. long, and the Lake Shore & Michigan Southern is making them 2,500 ft. long where there is room. The length is determined by the maximum amount of water which is to be delivered into one locomotive tank, or the track tanks are made of sufficient length that the tanks of two locomotives coupled together can be filled with water; this is to provide for "double-heading"; the scoop of the leading locomotive is dropped at the approach to the track tank, and the scoop of the other locomotive is dropped when the middle of the track tank is reached. It is necessary to make the tanks level, but it is not necessary to locate them on tangents; the Philadelphia & Reading has a tank on a curve of 2 deg.; some of the railroads in England do not hesitate to locate track tanks on curves.

In America the tank is usually made of steel plate $^3/_{16}$ in. or ¼ in. thick, bent lengthwise to the shape of the tank, and having riveted to the outside upper edges rolled sections, such as channels or angles, by means of which the tanks are supported upon the cross-ties. There are in use on the Chicago, Milwaukee & St. Paul Railway two track tanks made up of cast-iron sections, each section being 6 ft. long. These cast-iron tanks do not rust out, not as rapidly, at least, as those made of plates. In England the tanks are made of sheet steel or iron; in a few cases cast-iron is used; each section is 6 ft. long.

The relative elevations of tank and of top of rail are governed by circumstances. In America the top edges of the sides of the tank are placed at about the same elevation as the top of the rail, the scoop on the tender is gaged from top of rail, and the lower end of the scoop has an extreme movement from a position 3 or 4 in. above top of rail to a position 3 or 4 in. below top of rail, the latter position for scooping water. In England the relative elevations of tank and top of rail are not so uniform, on some railroads the top of rail immediately at the tank is depressed 6 in. below the normal position, or to an elevation about 2½ in. below the top of tank, this elevation being about 1½ in. below the level of the water in the tank. The change in elevation of the rail, 6 in., is made in a distance of 180 ft. There are advantages to this arrangement; it is not necessary to operate the scoop through such extreme limits, but it would be best, probably, to have the arrangement such that the scoop would need to be dropped into the water, otherwise the scoop would clean out the water in the trough.

A slope is provided at each end of the track tank. The slope usually provided is too abrupt; in England an easier slope is provided. Of course, it happens sometimes, when the raising of the scoop is dependent upon human energy, that it is neglected or some of the machinery is out of order, and the end of the track tank is torn out. To facilitate repairs the lower end of the scoop is made in such a way as to be easily renewable, and the end of the track tank may be made of a piece of plank bolted to the tank. If the slope is 20 ft. or 25 ft. long the tank will be injured less frequently.

If the inlet is in the end of the tank and the water is directed lengthwise of the tank, then the water may be forced into the tank at considerable velocity, and so reduce the time of flow to the opposite end; on the other hand, if the water is admitted vertically through the bottom of the tank the water must be run in slowly enough to prevent overflowing the sides. The bottom

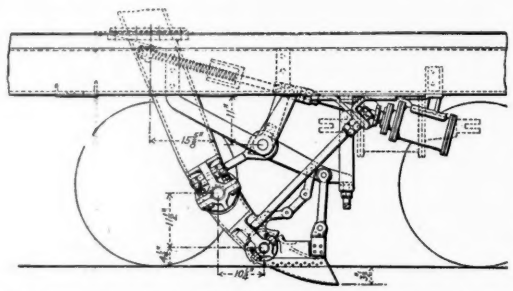


Fig. 2.—Water Scoop Used on the New York Central. Operated by Compressed Air.

inlet may be used and the water be admitted at a considerable velocity by placing a deflector at the inlet so that a part of the water will be directed toward one end of the tank and the remainder be directed toward the other end. The bottom inlet is the usual one, and this is covered with a grating to keep out heavy, solid substances. Disregarding any possible velocity head, the location of the inlet, or inlets, for most rapid filling will be understood readily from the following explanation: If the tank is 1,600 ft. long and 7 in. deep, and the one inlet located at one end, the gravity head is, of course, 7 in. in 1,600 ft., and frequently this is overcome by a strong wind blowing in a direction opposite to the flow; if the inlet is placed at the middle of the length, the gravity head is 7 in. in 800 ft.; with two inlets each should be placed at a distance from each end equal to one-quarter the length of the tank. If there is to be only one inlet for each tank and this one located at the end, the approach end should be preferred. If the water is to be kept from freezing by circulating it through the tanks and through injectors or other heaters, the relative locations of inlets and outlets will be such that there will be no "short circuiting" of the heated water, and

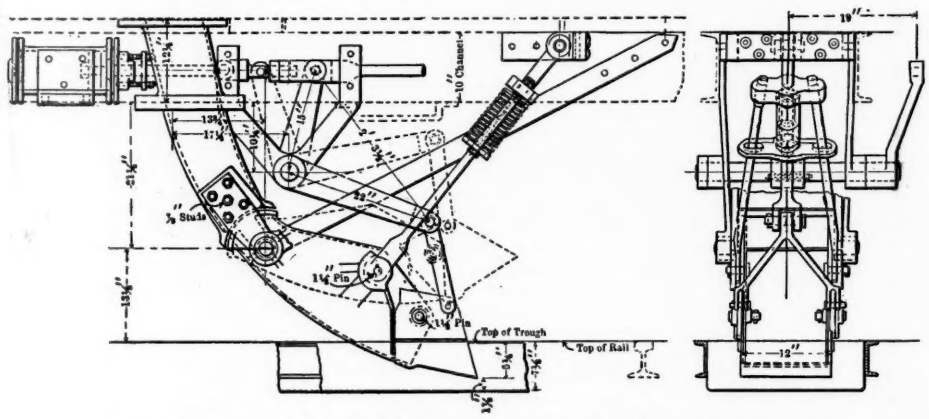


Fig. 3.—Water Scoop Used on the Michigan Central. Operated by Compressed Air.

therefore no "dead ends" in the tanks. The general practice in America is to control the flow of water into the tanks by means of a valve operated by the attendant at the pump house. Immediately after a scoop has been run through the tank the attendant opens the valve through which is controlled the flow of water into that tank. Sometimes an annunciator is placed in the pump house to give warning when the tank is filled, and sometimes the attendant must go to the tank and see when it is full. At other times the attendant opens the valve a certain amount and leaves it open for a certain length of time, and then closes the valve. All of these uncertain conditions make possible, between engine crews and pump attendants, disputes concerning the amount of water in tanks in various times. A more positive, automatic arrangement is used in England, the controlling valve being operated by means of a large float, the float being in a tank of water which is connected to the track tank by an equalizing pipe.

When track tanks are in use in climates sufficiently cold to freeze the water, provision must be made to keep the water above the freezing temperature, or the tanks must be put out of service during the winter. One of two means may be used to prevent ice forming in the tanks; steam may be blown into the water in the tanks, or the water may be circulated by means of an injector and so heated, or by a pump delivering the water through a heater. The Philadelphia & Reading admit steam to the tank through the bottom of the tank. A quite similar method is used on the New York Central. The steam inlets are placed 30 ft. apart in the Philadelphia & Reading tank. The Lake Shore & Michigan Southern prefer to locate the steam inlets in the vertical sides of the tank; the explanation for this preference is given by Mr. Rockwell, principal assistant engineer, that the water from the tank cannot flow by gravitation into the steam-pipe, and there is not the necessity of maintaining a pressure of steam sufficient to force the water from the steam-pipe. The steam connection used on the Michigan Central Railroad is made at the side of the tank. The Chicago, Milwaukee & St. Paul use the circulating system, circulating the water through the tanks and a heater by means of a pump. The Pennsylvania uses a circulating system, the heating and circulating being done by means of a No. 9 ejector for two tanks about 1,200 ft. long. By manipulation of the valves either tank can be filled independently, both can be filled at the same time, the water in either track can be circulated, and either track tank can be washed out. Means for washing out track tanks are sometimes neglected. The circulating and the water-pipe lines in the Pennsylvania Railroad layout are laid in the same box, made of 1½ in. hemlock and filled with puddled clay.

Water Scoops.—Mr. F. W. Webb, Chief Mechanical Engineer of the London & North Western, wrote that water scoops and track tanks were first introduced on that railroad in 1857. The London & North Western is supplied with track tanks all over the system, and it is seldom that water is delivered to the locomotive tank from water columns. In 1870 Mr. William Buchanan designed for the New York Central a water scoop, which was then designated "a jerk water"; the scoop was placed back of the rear truck of the tender, and the pipe leading to the tender tank was back of, and outside of, the tender tank.

The Baltimore & Ohio scoop is operated by means of a lever which is located in the gangway between tender and engine. The scoop is lowered against the compression of a spring. This spring counterbalances the weight of the pivoted part. The hood over the inlet to the scoop is put on so that the water striking against it will assist in raising the scoop from the water, because at high speeds a considerable force is needed to raise the scoop. This form of inlet produces considerable splashing, and in later designs this objection has been corrected by presenting to the water only the edges of the sides and bottom walls of the intake. A shield in front of the scoop in the raised position is provided to keep out ballast, etc. In cold climates the scoops must be kept free from ice, and to this end steam is directed to the trunnions of the scoop and to the inlet end. The exhaust from the air pumps might be utilized for this purpose. To prevent lowering the scoop far enough to come into contact with the bottom of the track tank, a positive adjustable stop is provided.

The Pennsylvania Railroad designed a balanced scoop which is pivoted in such a place that the water striking the back end, back of the pivot, counteracts the opposite effect of the water at the inlet end of the scoop. This scoop is patented.

More recently there have been designed several scoops with two pivoted sections, the lower one being short, so that it is tipped out of the water easily. Such a scoop is used by the Lake Shore & Michigan Southern. The same design is used on the Central Railroad of New Jersey. A scoop in which is used the same idea of two sections was developed on the New York Central, and is also being used on the Michigan Central Railway and other railroads. These scoops shown in Figs. 2 and 3 are operated either by compressed air or by hand. The method of lifting the scoop shown in Fig. 2 is that the link attached to the outer end tips the outer end first and raises the scoop part way before the other link connection comes into play, then the movement is completed with the lifting being done through the inner link, the outer link becoming loose. The reverse is the case when the scoop is dropped. The stop for the lowest position is shown as engaging a continuation of the bell-crank arm. The adjusting screw and nut provide a means of changing the lowest position of the scoop. The scoop is locked in the raised position by a piston which is forced outward by a coiled spring, the air for raising the scoop passes through this locking cylinder and forces the piston back against the spring and releases the lock, the air passing thence to the operating cylinder. Mr.

Ball advises that the operation of raising or of lowering the scoop is almost instantaneous. The air is controlled by a valve located in the gangway. In the design shown, Fig. 3, there is only one link attached to the scoop; this connection is made to the outer section, and when the outer section is raised a short distance it comes into contact with stops on the other section and both are raised together. When the shorter section is turned above the horizontal position the force of the water assists the raising, and it is not difficult to tip up the short section. The coiled springs are compressed when the scoop is thrown down, and they will support the scoop above the top of rail if the scoop is thrown out of the water by the incline at the end of the track tank, or if the locking in the raised position is not secure. This scoop is locked up by means of a pin placed back of the hand-operating lever.

It is not necessary to make a closely fitting joint between the pivoted section of the scoop and the fixed portion; the opening may be as wide as ½ in., providing the edges of the fixed part do not project inside the opening of the pivoted part; therefore just a rough finishing of the adjacent surfaces of the castings is necessary.

The pipe inside the locomotive tank may be made entirely of cast-iron, or there may be only a cast-iron flange at the bottom, and to this be attached a pipe made of light material.

It is important that the height of the scoops be gaged frequently, to insure that they cannot be dropped low enough to strike the bottom of the track tank, and to insure that they can be dropped into the water; the limits are small, and when it is considered that the height of scoops is varied by the action of the truck springs, wear of journals, bearings and other parts, the importance of the watchfulness is apparent. On some railroads it is required that the scoops on locomotives hauling important trains be inspected every day, and, generally, the scoops should be inspected and the bearings lubricated sufficiently often to insure positive working. A gage can be designed for this purpose.

The importance of supplying water to locomotive tanks while the locomotive is in motion is being more generally appreciated, and those railroads which have been placing scoops on only passenger locomotives are now equipping freight locomotives; the saving in time and in wear and tear of rolling equipment when traffic is heavy is considered sufficient to more than offset the expense of track tanks and scoops.

DISCUSSION.

Mr. F. F. Gaines (Lehigh Valley)—Mr. Whyte speaks of locating the cranes at suitable points in the yard service. We have gone further and taken up the question of the proper location of the water cranes or tanks, on the road proper. In my experience I have seen water cranes located in the most ill-advised places that could be found, in places where the train would be standing on a curve or at the foot of a grade, or where some other natural obstacle might be in the way, so that it would be difficult to pull out and start the train after taking water. The form of spout is another thing to which attention should be called. It is sometimes a great help to the fireman when he can have the three or four minutes that the water is running into the tank, to look at the fire, instead of holding up the water-spout. As an alternative to having a crane with the hinged joint to take care of variations in different heights of tanks, I would state it is our practice to use a standard height of crane, 12 ft. over the rail, and then take care of the variation in tracks by having a boot-leg, nothing more or less than a light, galvanized iron comb hanging on chains. When you sweep past the coal ports, these flexible boot legs are pushed aside, and when you come to the manhole it drops down and yet it is long enough to deliver water to the lowest tank without spilling or trouble of that kind.

Mr. E. W. Pratt (C. & N. W.)—A slight addition to the construction of some of these tanks, where the water is delivered directly to the tender of the locomotive from the tank, would be in placing a drip pipe underneath the base of the spout when it is in the position of disuse, so that the water would be carried away from the track. Especially in winter, in the coldest portions of the country, is this of advantage, and we have found that by discharging the exhaust from the steam pump into the base of this drip pipe, the steam would rise and not only keep the connection between the drip pipe and the sewer open, but except in the most extreme weather and hardest winds, would keep a great deal of the ice out of the spout.

Prof. W. F. M. Goss (Purdue University)—Referring to these small tanks used in English practice, I would say that it is my understanding that these are used when the water comes from some central source of supply, as for example the municipal piping system. In American practice, when water is taken from the city system, the stand pipe is often coupled directly to the mains and provision is made for meeting the stresses which are set up when the water is shut off, by having ample relief valves. This small tank, as I understand it, serves practically as a substitute for such a system of relief valves, since the draft on the city mains is through a comparatively small pipe and is stopped gradually by the floating valve.

Mr. H. H. Vaughan (Lake Shore)—I call particular attention to the English construction shown, of sloping the ends of the track tanks with a gradual slope. That appears to me to be a very important thing. In figures 23 and 26, two track tanks are shown which are in use on American railroads, and in both of these tanks the end slope is very abrupt. I do not think our experience is isolated in saying that this abrupt slope does not lift the water scoop if it is not properly raised before coming to the end of the tank. I would also call attention to the fact that it is necessary in these scoops to properly stay the tub end of the water scoop pipe. There is a very heavy drain on the scoop when taking water at high speed, and if not thoroughly stayed with the top of the tank, there is a liability for the connections at the bottom to gradually work loose and sometimes break.

In connection with the formulae for theoretical height of water at given speeds, we made a test in reference to that and we found the speed to accord almost exactly with Prof. Church's formula. At about half a mile an hour above the speed given in the formula for the height to the top of the scoop pipe of the tank, we began to get a little water, and at about two miles an hour above that, we got 20 in. in the tank, and the evidence seems to show that the formula can be depended on.

A New "Little Giant" Drill.

We illustrate herewith a new reversible drill of the "Little Giant" type recently developed and put on the market by the Chicago Pneumatic Tool Co. This machine was primarily designed to meet the want of customers who require a drill for general use, but whose work is not sufficiently specialized to warrant the purchase of any one of the "Little Giant" exclusive reaming and tapping machines.

The motor is of the same general construction as the previous types of "Little Giant" drills, the distinguishing feature of which is four single-acting pistons coupled to

Reversible "Little Giant" Drill.

one crank shaft at an angle of 90 deg.; the pistons of each pair traveling in opposite directions at all times, insuring a well-balanced and durable engine. All moving parts are in an oil-tight case and each pair of cylinders is controlled by a balanced piston slide valve. To this has been added a simple reverse valve of the same construction as is found in the No. 11 and 12 machines, but so situated that it does not interfere with the feed screw when the device is used as a simple drilling machine.

The controlling lever may be removed from the motor when not required as reversible machine. It can then be controlled with the ordinary throttle, which is situated at side of machine as in the plain drills. The reverse valve can be used as a throttle valve, however, when very rapid and accurate reverse motion is required, as would be the case when the motor was used in connection with machine for setting locomotive slide valves, or tapping in a fixed distance or to the bottom, and various other applications. The motor is made in sizes Nos. 00, 10 and 22, which are the same sizes as plain drills Nos. 0, 1 and 2 respectively. Like parts of these drills are interchangeable with the plain drills of the same size, features which will be appreciated by the trade, as this avoids complication of parts.

Some of the improvements to be found in these drills are as follows: All bearings are furnished with removable bushings; the crank journals have been increased by 50 per cent.; the crank pinion is now shrouded on both ends (formerly on one end only), which will prevent the teeth from breaking; the upper and lower bearings for the crank shaft are bronze; sleeves of ball and socket form easily removed, no screws being required to hold them in place, which form of bearing insures perfect alignment always, and consequent increase in speed and power; hardened steel eccentric straps to connect the valves to the crank shaft in place of bronze used formerly; oil plugs have been dispensed with; oil is poured in through the handle, and, as it is impossible to use the drill without this handle, and nothing but the handle will fit the hole, it must be replaced even by the most careless workman, and this insures long life to working parts; a leather-packed stuffing box is supplied to keep the oil from escaping; every moving part is hardened and ground to fit.

Foreign Railroad Notes.

The Austrian Railroad Ministry has approved the appointment of a woman to be station-mistress at Vilpian, on the Bozen & Meran Railroad, a short line in the Tyrol.

Beginning with June 5, 12 trains each way daily have run between Milan and Porto Ceresio, on Lake Lugano, a distance of 49 miles, propelled by electricity. The time is 77 minutes, which is fast for Italy. The train consists of one motor car and, when there are passengers enough, one trailer. The railroad was built as a steam tramway.

The railroad in German Southwest Africa (2 ft. gage), from Swakopmund to Windhock, at the end of March, had been completed for 212 miles, while the road-bed was nearly ready 25 miles further.

A Broken Axle and a Derailment.

On April 25 a serious accident occurred to a heavily laden passenger train near Hackney Downs, on the Great Eastern (England) road. It was due to a cause now uncommon, viz., the breaking of an axle; the leading axle of the third car from the engine. Soon after the break the train reached a diamond crossing and while the engine and first two cars went along the right road, the remainder of the train followed the diverging line. As the couplings held, the third and fourth cars were dragged off the line and ran on the ground to a bridge (over Amherst road) when the third and fourth vehicles were wrecked, causing the death of three persons and injuries to 200 others.

The axle, which was 4⅛ in. in diameter at its center, was made of mild steel, and it was one of a consignment of 100 which were purchased by the company from Messrs. Cammell & Co., in November, 1900. These axles had been specially bought at an exceptionally high price from Messrs. Cammell on account of their superior quality. It is the custom of the company to test to destruction 2 per cent. of all axles bought, and two axles of this consignment are stated to have been so tested with very satisfactory results. This axle had only been in use about four months. It had never been back in the shops for repair since going out on the line, so the only examinations it would have undergone would have been those of the carriage examiners at the yards. No report was ever made by these examiners of any defect in this axle.

The fracture showed signs of a flaw, which was undoubtedly the ultimate cause of the breakage. The flaw seems to have originally formed at a short distance below the surface, and to have extended towards the center until it covered about two-fifths of the area of the section. The latter part of the spreading appeared to have taken place rapidly, the final break evidently occurring quite suddenly.

The Board of Trade Inspector does not blame any servant of the company, but the occasion is taken to point out that "it is very unsatisfactory that no method has yet been devised by means of which it can be ascertained whether an axle is structurally perfect throughout. Some method by which flaws such as that which led to this accident can be detected is much needed."

Chicago Freight Handlers Strike.

Nearly 9,000 freight handlers in Chicago went out on a strike on Monday, July 7, as a result of a refusal on the part of the various roads entering the city to concede a wage scale contained in a schedule presented by the union recently. At the time this schedule was presented the railroads submitted a counter proposition granting some increases, but did not recognize the union. The scale submitted by the roads shows: Receiving clerks, first three months, $55; after three months, $60. Check clerks in transfer and freight houses, $55 and $60 for these respective periods. Delivery clerks or delivery men, $50 and $55 on the same basis. Stowers, first 30 days, 18c. an hour; afterward, 18½c. Callers, scalers, sealers and coopers, 17c. and 18c. for first 30 days and afterward, respectively. Truckers, 16c. and 17c. Receiving clerks who classify shall receive $5 a month additional. The day was set as being from 7 a. m. to 6 p. m., with one hour for dinner.

The union claimed that in some cases this was a reduction, and where there were advances they were too slight to be satisfactory. As the railroads refused any further concessions the members of the union were called out, and as a result some 27 freight houses were practically idle. The teamsters' union declared itself to be in sympathy with the strikers, but it does not appear that the freight house men were materially helped by any actual stoppage of work by teamsters.

The State Board of Arbitration shortly after the strike was declared made a formal offer to arbitrate the questions involved. It will be the duty of this board to make an investigation of the strike. The law provides that in any case where the public is inconvenienced as regards food, fuel, light, transportation or communication it shall be the duty of the board to investigate the causes of the dispute and its effects, placing the blame where it belongs, by a public report. At the present writing (Wednesday) the chairman of the State Arbitration Committee predicts an early settlement. The railway clerks' union voted down a resolution of sympathy; this, with the lack of assistance from the teamsters, discouraged the strikers. The railroads appear to have kept perishable freight moving fairly well, but in other merchandise the stoppage was serious. Wholesale merchants told the reporters that their out of town business was totally suspended.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Track in Tunnels—Some New Questions.

The cost and difficulty of maintaining railroad tracks in tunnels is not a new topic, but it is always important. Just now it is much more important than ever before. That is, while it is not very important to a great number of people, it is one of the most important matters to a few people.

Authorities say that it costs at least twice as much to keep up track in tunnels as in the open. Obviously, this must vary between wide limits. In a short and dry tunnel with infrequent traffic, it might be even cheaper to keep up track than in the open, because it is not exposed to snow, rain and frost. On the other hand, in a long tunnel where trains pass at short intervals, and particularly if the tunnel is damp, it might easily happen that the cost of maintenance would be considerably more than twice as much as in the open. For instance, in a situation like the Park avenue tunnel of the New York Central Railroad men must work at great disadvantage. They hardly get to work before they must seek refuge. Aside from the constant interruption by passing trains it is quite obvious that men cannot work as fast or as efficiently in the darkness as in the light. Furthermore, it is obvious that the corrosion and rusting of rails and fastenings must proceed faster where the gases are confined, and especially if the tunnel is damp. We printed some important information on this particular branch of the subject in 1900 (p. 864). The observations of Mr. Thomas Andrews led him to believe that, generally speaking, the life of rails in tunnels was not more than one-half as long as in the open; but in some special cases the difference is still greater. One British railroad officer had painted the rails in all wet tunnels, or all tunnels more than half a mile long, and judged that he secured 30 to 50 per cent. longer life for the rails. But this does not help the life of ties, or the cost of labor in dark and dangerous places.

These are ancient facts, but now arises quite a new set of conditions more formidable and embarrassing than the old ones. There are tunnels now building of great length and others projected of still greater length, through which trains will be hauled by electric motors; and the passage of trains in these tunnels will be as frequent as in any tunnel now existing on this side of the ocean, not excepting the Park avenue tunnel, but excepting the Boston subway. These new tunnels will have close cross sections, and some of them will be circular in cross section, being tube tunnels. Furthermore, a considerable amount of the tunnel space will be taken up by conduits, for current and for other purposes.

If anybody will plot a cross section of a circular tunnel, and put in the conduits necessary to take the current for a heavy traffic, he will discover that he has little room left for track. If he will then try to put himself in the position of having to renew cross ties, he will find that the situation is embarrassing. If, beyond this, he proposes to work his trains by taking current from an unprotected third rail he will find still further embarrassment.

It will be seen that the situation calls for a kind of track which has not yet been devised, or at least which has not yet been proved by long and hard service.

A permanent track, or at least a track of great endurance, which can also be surfaced and repaired conveniently, in restricted space, would be carefully considered by the engineers responsible for some of these new enterprises, even if it cost materially more than ordinary track. Here is a chance for engineers who are clever at original design.

Signaling Fast Trains in Fog.

The reader will recall a number of reports, recently given in these columns, of collisions which have occurred in England in times of fog where the provisions, elaborate as they are, for supplementing visual signals by torpedoes have not fully met the demands that were made on them. Not that the torpedoes have failed to explode, but the methods and discipline necessary to make them useful have been lacking or faulty. The correction of the deficiencies which exist in the present arrangements for dealing with fogs is by no means easy, and, of course, our English friends realize the difficulties; and one of them, writing to us on the subject, asks us to give him some enlightenment. He says that the principal developments in England during the past few years have been (1) that the number of signals increases faster than the number of men available for hand fog-signaling and (2) that Raven's apparatus for sounding a whistle in the cab of the locomotive is now used throughout the main line of the North Eastern Railway, all the engines being fitted. (This was described in the *Railroad Gazette* of March 8, 1901. When a semaphore arm is put into the horizontal position it sets a lever or trip which will open a valve on a passing locomotive.) The first point is of interest as showing that even in England, where labor is cheap, there is sometimes a limit to the number of men that it is thought profitable to hire. The second, which appears to mark progress, can hardly be said to afford specific encouragement, for the fact that only one road has adopted a cab signal indicates that there may be special reasons for the use of the device on that one; that with all other roads the objections to cab signals remain as strong as ever.

This problem is no easier here than in England, and, indeed, may be even harder to deal with, by reason of the fewer fogs and the consequent difficulty in maintaining discipline; so that our correspondent can hardly expect much light from America. Moreover, but a very few American railroads have done anything at all in this line, and those few have done but little. The main principles are, however, nearly or quite the same in both countries and it may not be amiss to restate these. In doing so we shall try to confine ourselves to that phase of the problem which is common to both countries; that is, the question of a signal, other than visual, to take the place of the ordinary semaphores, whenever these are obscured by fog or smoke.

The first distinctive principle of any fixed signal (a signal to give its indication at a fixed point on the line of a railroad), to be used in a fog, is that it must be a distant signal. The engineman cannot see (nor hear) far ahead, so he must have time and space in which to obey the signal after he passes it. The second principle is not peculiar to fog signals, but is of the first importance in considering the question, because everybody seems to have found it so hard to comply with; it is the principle that a signal must indicate "stop" when it is out of order. We need not consider any others, as these two have proved nearly or quite sufficient to baffle all experimenters so far. The first principle forbids the use of automatic torpedo machines, as a distant signal must be passed while it is "on," and torpedoes will therefore be used up so rapidly that we must either have a very large magazine or else replenish it very frequently. Both of these conditions are extremely objectionable. The torpedo machines thus far used have been fixed at the home signals and thus have served, not to warn the engineman what to do, but simply to notify him that he had already failed in his duty. The second principle is violated by all of the audible signals that we know of. In all of them the absence of a sound indicates all-clear; so that if the apparatus fails to act the engineman assumes that the road is clear, when he ought to assume that it is blocked. That this defect in a signal is of practical importance, and not merely a theory to be used in academic discussions, is shown by the fact that on those railroads in England where fogs are frequent and where men are regularly stationed at the signals to put torpedoes on the rails, the unofficial hand-motions given by the fogmen to the enginemen (when the signals are at all-clear) have come to be the important feature of the signaling. In other words, the principle that a signal telling when to proceed is more satisfactory than one telling when to stop, is appreciated by intelligent enginemen, as well as by signal engineers.

About the only important experience with audible signals in America is that in the Fourth Avenue tunnel, New York City, and that is probably fresh in the reader's memory. On the occasion of the accident of January 8 a torpedo exploded, but it was at the home signal and the warning was ineffectual. Possibly a more alert and competent engineman would have stopped in the 400 ft. which happened in that case to be available, but that does not affect our present argument. Experiments after the collision appear to have shown that the adjustment of a torpedo machine to a variety of tires, old and new, wide and narrow, was a matter of some difficulty. Gongs have been (and are) used in the tunnel, but appear to be treated as secondary to the torpedoes. Duplicate torpedo machines have now been fitted to the home signals; and as a track-circuit lock holds the home signal in the stop position until a train has passed 800 ft. beyond it, the audible signals are now distant signals to that extent. But both torpedo and gong still violate the second fundamental principle stated above, and, in the terse language of Mr. C. H. Platt at the investigation of the late disaster, the more highly developed they are, the greater the element of danger which they introduce. So far as we can see, the apparatus used on the North Eastern of England is subject to the same objection. Mr. Wilfrid L. Boult, of London, devised an arrangement of magnets and induction coils by which he gave an electric signal on a locomotive without making contact; this was ingenious, and was free from some serious objections to other schemes, but it was costly and it appears to have made no progress.

The only way that we can think of by which to make an audible signal comply with our second principle, is to cause it to sound for "all-right" instead of sounding for "stop" or "caution." Why the experimenters do not try this plan we do not know; perhaps it is because they have not yet got through with dealing with more immediate and pressing problems than that of warning the engineman when the apparatus is out of order. The Miller (visual) cab signal claims to provide this warning (if the failure of apparatus occurs before the engine passes the last preceding signal) but the Miller, as described in the published illustrations, is not entirely free from objections, as the reader will have seen from recent criticisms in our columns. These criticisms, however, have to do with the Miller apparatus when used as an automatic block signal, independent of all roadside visual signals; and a discussion of the system is hardly germane to our present subject. Our English friends will probably prefer to have us stick to the question of audible or cab signals to be used as auxiliaries to roadside visual signals.

But we cannot stick to it any farther; for until some one is willing to try giving a sound for all-clear instead of giving it for caution, we know of nothing that can be done. Assuming that, in doing nothing in this direction, the signal engineers are right; and that we, in recommending such an expedient, are wrong, or are advocating an unwarrantable expense, the most hopeful way out of the specific difficulties which our English friends are now wrestling with, is in giving up audible and cab signals, and devoting more attention to the existing visual roadside signals. It is to be remembered that no fog is absolutely impenetrable. Our semaphores are never completely obscured, as if buried in a black snow bank. Even in a London fog one can usually see well-defined objects five feet away, if we are correctly informed. This being so, we need not follow the theory that a visual signal is *entirely* useless as soon as a fog occurs. Enginemen can at least see a semaphore post, howsoever dense the fog, if they go slowly enough; and the arm is as easily discerned as the post, if it is at the right level. As is well known, some very high English semaphores have duplicate arms at about the level of the engineman's eye.

If an engineman can find a semaphore while moving at moderate speed, he can find it at higher speed also, if he only looks for it at just the right place; and any device which will enable him to do this will answer all of his complaints about troubles due to fog. Landmarks to aid the runner in quickly deciding whether the distant signal is 1,000, 100 or 10 ft. ahead constitute the whole remedy. Except, perhaps, in the very worst conditions, such as those in

and around London, this remedy can be very cheaply provided. This question came up a year ago (Feb. 1, 1901, page 80) and we advocated a white fence, to be set along the line close to the track, for 100, 500 or 1,000 ft. Such a fence could be begun (1,000 ft. before reaching the distant signal) 5 ft. high and the height could be gradually increased to 10 ft. at a point 50 ft. short of the signal post. Or, it could be begun high, descend to a height of 5 ft. and then rise again. It would perhaps be sufficient if it consisted of posts only. A fence could be provided for the approaches of both the distant and the home signals. We have heard no criticism of this suggestion. In a dark tunnel incandescent electric lights of 16 c. p. or less would answer the same purpose that fence posts answer in the open country.

Even if a fog were an absolute and complete obstacle to the use of visual signals we are not confined to audible signals. The principle employed in the devices which are used to warn brakemen, on the tops of cars, when they are approaching overhead bridges, is applicable to the engineman in the locomotive.

As long as we aim to facilitate the use of the signals that we have, rather than to furnish a parallel or auxiliary system, we avoid the questions and the uncertainties which arise when we divide the engineman's attention or give him an opportunity to choose between two different ways of accomplishing the same thing. If an auxiliary signal is used all the time, regardless of the weather, the engineman will, if it is easier than the visual signal, depend upon it as the primary signal, and thus will be liable to neglect the semaphore. Many men would get into the habit of doing this, in spite of good intentions. If an auxiliary signal is used only in time of fog, we have the disadvantage of an unfamiliar signal, and of the added liability to disorder which is inseparable from a mechanical device that is only infrequently used. And, finally, if simple landmarks, costing very little for maintenance, are sufficient to make visual signals adequate in a foggy atmosphere, the use of more costly means for accomplishing the same object is an unjustifiable expenditure of money.

One of the expedients which was early adopted in the Southern States to get around the law forbidding white persons and negroes to ride in the same car, was to use a borrowed baby. A negro "mammy" who is too neat to ride with the ordinary run of "niggers," and who feels the necessity of making a journey by railroad, borrows an infant, from some white family with which she is on good terms, and takes it along; and, if she is not gone long enough to cause the infant discomfort, the plan is perfectly successful; being nurse to a white passenger, the woman lawfully rides in the white folks' car. Taking advantage of this exception to the Jim Crow rule, the negroes of New Orleans are now proposing to try to invalidate the new law of Louisiana requiring the separation of the races on street cars. Two negro girls, one carrying a white child and the other without one, will board the same (white) car and challenge the conductor to disturb them. If the one who is not a nurse is ejected, her lawyer will ask to have the law declared unconstitutional, as granting unequal privileges. According to the veracious New York newspaper which reports this scheme of the lawyers to work up a little litigation, the colored people of New Orleans have already raised the money to test the validity of this law. If we may judge by past experience, the lawyer who acts for the nurse girls will do well to make sure, beforehand, that this last part of the statement is true. So far as the general public is concerned, either white or black, the interest in separate-car laws seems to be rather languid. In Virginia the cars on one interurban electric line are fitted to comply with the law by the use of the simple expedient of two placards, one in each end of the car, reading, respectively: "SEATS IN THIS END FOR WHITE" and "SEATS IN THIS END FOR COLORED." When such a car is full, the invisible dividing line must, we should think, find some difficulty in deciding what its existence amounts to.

Seven thousand seven hundred and sixteen miles for $67 is the latest low-price ticket offered by the Southern Railway. This distance is that from New York to San Francisco and back, by way of Washington, Atlanta and New Orleans, and the ticket is offered for special excursions to be run in August. The route from Washington is over the Southern, the Atlanta & West Point, the Western of Alabama, the Louisville & Nashville and the Southern Pacific. The rate figures out about 8⅔ mills per mile. Very low rates have been made by all of the lines from the east to the Pacific coast during the past few months, but this one gives more miles for the money than any other that we have observed. Moreover, the tickets carry full first-class privileges. If these long lines continue this "friendly" competition, they will wake up some morning to find themselves rivaling the Russian government, which carries emigrants to Siberia at rates so low that on each ticket there is a definite loss of 50 to 75 per cent. or more. The notice issued by the Southern Railway for the California special tickets says:

"Tickets will be on sale Aug. 1 to 7, inclusive, to either Los Angeles or San Francisco, and the final limit on the return is Sept. 30. Through sleepers are run from Washington to Los Angeles and San Francisco the year round, leaving each terminal every Monday, Wednesday and Friday. The conductor is familiar with points of local or historic interest and calls attention to them before and while passing. The stop-over privileges are generous. By Monday departure Sunday travel may be avoided."

The foregoing affords a striking example of low-price passenger service. An example equally striking in another direction is the present time-table of the New York Central. This is an example of speed and frequency, two advantages for which a railroad often has to reduce its profits more than it would reduce them by making a reduction in fares. The present Central time-table shows no less than 17 through trains out of New York for points far beyond the termini of its own lines. The fact that one of these trains runs to Chicago in 20 hours, and that four others run to that city in 24 hours, has already been mentioned in these columns. Increases in passenger accommodation, stimulated by the heavy travel due to the general prosperity of the country, have been common the present season, and are too familiar to the reader to need mention, but this particular case is probably one of the most important. Of the 17 trains 11 go through to Chicago or St. Louis; though one of the mail trains is advertised to take passengers only as far as Rochester. The other six of the 17 trains run to Montreal, Ogdensburg, Rutland, etc. Besides this there are four trains to Buffalo and five to less distant points (not to mention accommodation trains), making 26 in all. The Saratoga Limited, down in the morning and up in the afternoon, and running at the speed of the Empire State express, faster even than the 20-hour trains, is this year entirely separate from the Albany flyer, which runs the year round. Besides the trains above mentioned, there are two expresses to North Adams, over the Harlem Division, and there are five trains over the West Shore which run through to Chicago or St. Louis.

NEW PUBLICATIONS.

A Practical Treatise on Modern Gas and Oil Engines. Third edition. By Frederick Grover, A. M. Inst. C. E. London: The Technical Publishing Co., Ltd.; 372 pages, 4½ x 7 in. Price 5s.

The first edition of this book was carefully reviewed in the *Railroad Gazette* of Jan. 28, 1898. Since then many additions have been made involving original research and noting modern practice. A new chapter on gas engine efficiency and the application of the entropy-temperature diagrams thereto is of importance, for engineers are using this method of analysis more and more. The value to the engineer of the abstract quantity "entropy" lies in the fact that by plotting changes of entropy as abscissæ and changes of temperature as ordinates, the area under the curve so plotted represents *heat units* and at once affords a picture of the heat interchanges in the cylinders that is easy of interpretation. The description of this method is one of the clearest and most concise that has come to our notice.

Acetylene gas is the subject of another interesting chapter. Herein are given the results of experiments made by the author upon the explosive properties of acetylene with especial reference to its application as a motive power. The results show that acetylene has many advantages for such a purpose, the only present limitations to its use being the price. The author states that a thermal efficiency of 35 per cent. may be expected from the use of this gas, and this statement is borne out by his experiments. The high power and convenience in generating this gas give it value for propelling light vehicles. The statement is made that 60 lbs. of calcium carbide and 32 lbs. of water for its reduction is sufficient to run a vehicle of one ton gross load for 10 hours. The author fails to state, however, what would be the average speed under the above conditions.

The treatment of "Producer Gas" has been greatly enlarged and descriptions of several of the more important gas apparatuses are given. Attention is especially drawn to the economy to be attained by the use of waste gases from blast furnaces for gas engines. When these gases are burned under boilers and the steam used as motive power it is rarely possible to obtain an efficiency of more than 8 per cent. An efficiency of 21 per cent. is obtainable by their direct use in gas engines.

Considerable space is devoted to the history and development of the oil engine and this portion of the book gives a good idea of modern English practice along this line.

The Electrical Catechism. Five hundred and thirty-three plain answers to 533 practical questions about electrical apparatus. Compiled from *Power*. New York: Hill Publishing Co. 1902. Price $2.

The title of this book tells the essential facts. It is a volume of 210 pages, octavo, with an index, and is another example of the numerous catechisms that have appeared since Forney started the fashion some 30 years ago. The aim of the author has been to discuss such matters as are likely to come within the range of the average central station or isolated plant engineer. That does not mean, however, that the book is merely elementary and popular; on the contrary, it goes somewhat deeply into principles and practice. For example, four chapters are given to the theory of alternating currents and to alternating current generators and circuits; one chapter deals with transformers, and another with motor circuits. It has never seemed to us that the catechism method of presentation was the most economical of time and intellectual energy for a grown-up man, but obviously, there must be a great number of people who like to get their information this way; otherwise the sales of catechisms would not be so great and constant as they are. Of the present work, a cursory examination gives a very favorable impression. The writer has the gift of clearness of expression, the illustrations are excellent and the topography and other mechanical features are satisfactory, though the proofreading is not absolutely perfect. The index is in good sized type and appears to be quite complete, giving the book in some degree the merits of a "dictionary" of the department of science of which it treats.

Steam Heating and Ventilation. By Wm. S. Monroe, M. Am. Soc. M. E. Octavo; 150 pages; 90 illustrations. New York: The Engineering Record. Price $2.00.

The chapters comprising this book were originally written as a series of articles for the *Engineering Record* and have been somewhat revised for their present use.

The theoretical considerations involved in the design of heating and ventilating plants have been dealt with briefly, and only those empirical formulae which are of direct practical bearing have been given. Each system of heating has been described in full, both as regards the general layout and the details of the important elements. The relative merits of each are given and the defects, if any, are pointed out.

Under the heading of mechanical ventilation, the author first goes into the general principles underlying this subject, and then takes up in detail the various systems employed. Concrete examples are here given.

The tone of the entire book indicates that it is written by one who has had considerable practical experience in the design and installation of heating and ventilating plants. The descriptions are clear and the data are compiled in convenient form for reference.

Moody's Manual of Corporation Securities. Third annual number. Large octavo; 2,256 pages. New York: John Moody & Co., 35 Nassau street. 1902. $7.50.

The third annual number of Moody's Manual appears greatly enlarged over previous issues, and includes a list and brief description of the securities, not only of steam railroads and of banks, but of gas, water, electric light and electric railroad companies, and of a large number of industrial and miscellaneous corporations. The first number, which appeared in 1900, contained 1,108 pages and covered 1,800 corporations. The second number, appearing last year, contained 1,523 pages and dealt with almost 4,500 corporations, and this present number, with 2,256 pages, covers approximately 10,000 corporations. The description of the securities of each corporation is put in simple, condensed form, which gives the book added value for ready reference. The volume is divided into eight sections which serve to classify the information.

TRADE CATALOGUES.

The Pratt & Whitney Co., Hartford, Conn., send a small descriptive pamphlet, which sets forth the several features of their new 10-in. by 5-ft. engine lathe. This machine is specially designed for the use of tool and model makers. The engravings have been well chosen, and are in themselves a good description of the lathe.

Air Compressors.—The American Air Compressor Works, at 26 Cortland street, New York, is putting on the market the Clayton air compressors. A pamphlet lately issued illustrates a few of the various types of steam and belt compressors which they make. Descriptive tables are given for the convenience of prospective buyers; also directions for erecting their compressors. The company has in the printer's hands a complete catalogue of its various products which will cover the entire field of air compressing machinery and specialties.

Coaling at Sea.—The Lidgerwood Mfg. Co., New York, has just issued a descriptive pamphlet entitled "Coaling at Sea." This pamphlet describes in detail the marine telpherage cableway as installed on the United States battleship "Illinois." The pamphlet contains 25 pages, and is profusely illustrated.

"*Cranes*" is the title of Catalogue No. 15, just issued by the Northern Engineering Works, Detroit, Mich. This pamphlet contains illustrations of the more important types of electric, steam and hand power cranes which they manufacture. The descriptions accompanying the engravings are only of a general nature. The company states that detailed specifications and full particulars will be submitted upon request. The catalogue contains 48 pages with 31 illustrations.

The Caskey Portable Pneumatic Punch is described and its advantages set forth in a pamphlet just issued by F. F. Slocomb & Co., Wilmington, Del. The essential features of this punch are: The hollow ball piston and oil intensifier. But one charge of air is required for the backward and forward motion of the piston. Several shop views show the application of the punch to various classes of work. Illustrations of several standard designs together with descriptive tables are given.

The River and Harbor Bill.

Copies of a 60-page pamphlet containing the Act making appropriations for the construction, repair and preservation of public works on rivers and harbors have been received, and show that the total amount appropriated is $65,107,602, or $5,054,837 more than the bill carried when it passed the House of Representatives. Of the total appropriation $25,521,442 is for the next fiscal year and $38,586,160 for continuing improvements after June 30, 1903. Some extracts from the Act are given below:

The provision of the Act of 1884 establishing the Missouri River Commission is repealed and that Commission abolished on June 30, of this year. The Commission must make a report to the Secretary of War of its proceedings since its last report, and of all its plans and systems of work, and shall transfer to him all its vessels, barges, machinery and instruments, and the Secretary of War shall have charge hereafter of all the work previously done by this Commission.

Another provision is for a board of five engineer officers of the Army, to whom shall be referred for consideration and recommendation all reports upon examinations and surveys provided for by Congress, and all projects or changes for works of river and harbor improvement, and shall determine the desirability of commencing or continuing improvements on which reports are required. When considered necessary the board shall make personal examinations of localities, and the board shall also report to the proper committees of the United States Senate and House of Representatives, upon request through the Chief of Engineers, upon any projects for which appropriations have been made, and the desirability of continuing or modifying the same. The board may rent quarters and employ such civil employees as the Chief of Engineers may deem necessary.

The President is requested to invite the Government of Great Britain to join in forming an International Commission of three members representing the United States and three the Dominion of Canada, to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all the waters of lakes and rivers whose natural outlet is the St. Lawrence River; also upon the maintenance and regulation of suitable levels, and the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation, of the diversion of these waters from their natural flow, and to report upon measures to regulate such diversion and recommend improvements and regulations in the interests of navigation, and to report upon the advisability of a dam at the outlet of Lake Erie, and, if advisable, recommend to their governments an agreement for building the dam, with an estimate of probable cost. The President is authorized to appoint one officer of the Corps of Engineers, one civil engineer well versed in the hydraulics of the Great Lakes, and one lawyer of experience in international and riparian law, the said commission being authorized to employ such persons as it deems needful, an expenditure of $20,000 out of the appropriation for St. Marys River being authorized.

The Act makes it the duty of the Secretary of War to prescribe such rules and regulations for the use, administration, and navigation of any and all canals and works of navigation as are now or hereafter may be owned, operated or maintained by the United States, and the speed of vessels in any public navigable channel improved under Congressional grant, as in his judgment public necessity requires.

Among the more important of the very large number of appropriations made by the Act are the following, most of them being authorized in accordance with reports previously sent to Congress to which reference is made, and the contracts in all cases to be made by the Secretary of War:

New England and Middle Atlantic States.—Boston, Mass., maintenance and general improvement, $100,000, and for 35-ft. channels 1,200 ft. wide from the Navy Yard at Charlestown to Chelsea bridge, and from Charles River bridge to President Roads, and 1,000 ft. wide from President Roads through Broad Sound to the ocean, $600,000, the entire cost not to exceed $3,000,000, exclusive of that amount. Improving Point Judith harbor of refuge, Rhode Island, continuing improvement, $100,000, and a board of engineers shall be appointed to examine harbors of refuge at Point Judith, Block Island and Great Salt Pond, Vineyard and Nantucket Sounds, and Cape Cod, and report what improvement is advisable in each, and the cost; for Providence River and harbor, R. I., lesser project, $100,000; New York harbor, maintenance, $50,000; Buttermilk channel, New York harbor, with channel not less than 30 ft. deep, $90,000; improving Fire Island inlet, $66,000; improving Arthur Kill from Kill von Kull to Raritan Bay, $100,000, the entire cost not to exceed $596,000, exclusive of amounts already appropriated, and the Secretary of War may modify the project by locating the channel north of Shooters Island; continuing improvement of East River and Hell Gate, $100,000; continuing improvement, Harlem River, $75,000; continuing improvement, Hudson River, $225,000; improvement of Delaware River with a channel 30 ft. deep and 600 ft. wide from Christian street, Philadelphia, to deep water in Delaware Bay, $600,000, the entire cost not to exceed $2,400,000 exclusive of amounts already appropriated; continuing improvement Potomac River, at Washington, $75,000; improving Anacostia River, at Washington, in the interests of commerce and navigation, in the section between the Navy Yard and the Potomac River, $150,000; continuing improvement, James River, Va., $300,000, of which not over one-half shall be spent above the city of Richmond; improving harbor of Southwest Baltimore, Md., $88,000, the entire cost not to exceed $222,000 exclusive of amounts already appropriated; improving channel, Curtis Bay, Baltimore harbor, to 30 ft. deep and 250 ft. wide, $50,000, and the entire cost not to exceed $146,000; improving Hampton Roads, Va., $225,000, of which $10,000 is appropriated; continuing improvement Norfolk, Va., harbor, $20,000.

Middle Western States and Lake Harbors.—Continuing improvement and dredging, Tonawanda harbor and Niagara River, N. Y., $257,700; improvement of the Lake Erie entrance to Black Rock harbor and Erie Basin, N. Y., $200,000, the entire cost not to exceed $614,643; continuing improvement harbor at Erie, Pa., $125,000; continuing improvement Conneaut harbor, Ohio, $200,000, the entire cost not to exceed $250,000 exclusive of amounts already appropriated; continuing improvement and maintenance, Ashtabula harbor, Ohio, $200,000, and Fairport, Ohio, $200,000; maintenance and improvement harbor at Cleveland, Ohio, $225,000, and the Secretary of War may have dredging done to 25 ft. deep in any part of said harbor, and for a better entrance to the harbor, and a new breakwater either of stone or timber cribs with concrete superstructure, $500,000, the entire improvement to cost not over $2,300,000; improving harbor at Sandusky, Ohio, $125,000; continuing improvement, Waukegan, Ill., $100,000, the entire project to cost not over $245,000 in addition to this appropriation; maintenance and improvement, Milwaukee harbor, Wis., $232,500, of which $150,000 may be spent for rebuilding and maintenance of the breakwater of the harbor of refuge; improving Monongahela River, Pa., including rebuilding of lock and dam, $200,000, the entire cost not to exceed $455,961 in addition to the present appropriation; continuing improvement, Ohio River, from its head to its mouth, $400,000, the law giving in great detail the various improvements to be made along the river, the amount appropriated for continuing construction of docks and dams, Nos. 2 to 6, inclusive, being $275,000, and the Secretary of War is directed to prepare a list of bridges across the Ohio River which are an impediment to safe and convenient navigation and report to Congress the necessary changes in any or all of them which can be made under existing law, and any legislation necessary to secure proper changes; improvement of Detroit River, from Detroit to Lake Erie, $500,000, the entire improvement to cost not over $1,250,000 in addition to this appropriation; improvement of St. Clair Flats Canal, $330,000; continuing improvement Illinois River, $75,000; continuing improvement Calumet River, Ill., $75,000 for dredging to 20 ft. up to 122d street, Chicago, and to 16 ft. from 122d street to the forks of the river, and a further examination shall be made with a view to getting a navigable channel 22 ft. deep from the mouth of the river to 106th street, Chicago; continuing improvement Chicago River, at Chicago, $306,457 in addition to $193,543 previously appropriated, all of which may be used for building turning basins in the river to be located under the direction of the Secretary of War; continuing improvement Mississippi River from the mouth of the Ohio to and including the mouth of the Missouri, $650,000, the entire improvement to cost not over $1,950,000 exclusive of amounts already appropriated, the amount to be limited to $650,000 a year for four years; continuing improvement, Mississippi River from the head of the Passes to the mouth of the Ohio, $2,200,000 to be spent under the plans of the Commission as approved by the Chief of Engineers, the entire amount authorized being $6,000,000, to be spent at the rate of $2,000,000 a year for three years, beginning July 1, 1903.

Southern and Southwestern States.—Maintenance of the harbor at Savannah, Ga., $50,000, and entire improvement to cost not over $1,000,000, and the navigable depth of 28 ft. at mean high water may be extended upstream as far as required; continuing improvement of Brunswick, Ga., $165,000; improvement of Biscayne Bay, Fla., to obtain a channel 18 ft. deep from Miami to the sea, and a basin 18 ft. deep and 1,600 ft. long and 500 ft. wide at the wharves at Miami, $50,000, the total cost to be not over $250,000, the basin and part of the channel to be built by the Florida East Coast Ry., and to be free to the use of the public; continuing improvement northwest entrance to the harbor at Key West, Fla., $100,000; continuing improvement and maintenance, Pensacola, Fla., harbor toward securing a channel 30 ft. deep and 500 ft. wide from the dock line at the east end of Pensacola to the Gulf of Mexico, $220,000; continuing improvement, Mobile, Ala., $300,000, with a view to ultimately securing a channel 23 ft. deep and 100 ft. wide, the cost not to exceed $200,000, in addition to the present appropriation; improving South West Pass of the Mississippi River with a view to securing a navigable depth of 35 ft., $750,000, the entire cost not to exceed $2,750,000 in addition to the amounts already appropriated, and the Secretary of War is directed to maintain the channel with the utmost efficiency; for maintenance of channel and repair of jetties at Sabine Pass, $185,000; completing north jetty, Aransas Pass, $250,000; improving Galveston harbor, main entrance, and restoration of jetties, $350,000, the entire cost not to exceed $400,000; improving Galveston channel to 30 ft. depth and the best width for the interests of commerce, $100,000, the entire work to cost not over $200,000, and the Secretary of War is directed to appoint a Board of Engineers to prepare plans and estimates for protecting Galveston from excessive storms; continuing improvement and maintenance, Cape Fear River, N. C., at and below Wilmington, $150,000; continuing improvement, St. Johns River from Jacksonville to the ocean, $350,000, the entire cost not to exceed $950,000, of which $150,000 may be spent for a sea-going suction dredge; continuing improvement Black Warrior, Warrior and Tombigbee rivers, Ala., $374,000, including locks and dams, the entire cost to be $500,000; continuing improvement Galveston Ship Canal and Buffalo Bayou, Tex., $300,000, the entire cost not to exceed $700,000; continuing improvement at Colbert and Bee Tree Shoals, Tennessee River, $200,000, the cost not to exceed $400,000; continuing improvement, Cumberland River below Nashville, $200,000; above Nashville, completion of lock and dam No. 1, $105,000, and the Secretary of War may lease to the highest responsible bidder the water power created by the dam.

Northwestern States and Pacific Coast.—Continuing improvement and maintenance, harbor of Duluth, Minn., $200,000, of which $100,000 shall be spent on rebuilding the piers at the Wisconsin entrance; continuing improvement San Diego, Cal., $75,000, the entire cost not to exceed $192,000 in addition to that amount; improving harbor at Wilmington, Cal., including construction or purchase of a suitable dredge, $250,000; construction of channel 300 ft. wide and 30 ft. deep between Straits of Karquines and the Golden Gate, San Pablo Bay, Cal., $100,000, the entire improvement to cost not over $281,000; improving Oakland harbor, Cal., $100,000; continuing improvement Puget Sound and waterway connecting it with Lakes Union and Washington, $160,000; continuing improvement and maintenance of reservoirs at headwaters of the Mississippi River, and improving that river between Brainerd, Minn., and Grand Rapids, $250,000; continuing improvement Mississippi River from the mouth of the Missouri River to St. Paul, $400,000 and additional contracts not to exceed $1,200,000, the amount to be limited to $400,000 a year for four years; Missouri River from Sioux City to its mouth, $175,000; continuing improvement mouth of the Columbia River, $500,000, the total cost not to be over $1,000,000.

For emergencies, such as restoration of channels, $200,000.

For surveys and investigations to be made by a Board of three Engineer officers appointed by the Secretary of War to determine the feasibility, and report plans and estimates of cost, of a navigable waterway 14 ft. deep from Lockport, Ill., by way of the Des Plaines and Illinois Rivers and by way of the Mississippi River to St. Louis, $200,000 is appropriated, of which $25,000 for the necessary examination from the mouth of the Illinois River to St. Louis shall be spent by the Mississippi River Commission.

Subject to the consent and approval of the Secretary of War and the Chief of Engineers, the Michigan Lake Superior Power Co., of Sault Ste. Marie, Mich., is authorized to divert water from the St. Marys River into its water-power canal now building at Sault Ste. Marie, so long as such works and diversion of water shall not injure navigation nor impair or diminish the water levels in Lake Superior or in the United States Ship Canal and locks or those connected with it, which now exist or may hereafter be built, the said company to establish, maintain and operate suitable and sufficient controlling works in the rapids of said river, and maintain and operate the canal and works in accordance with any rules and regulations hereafter recommended by any International Commission that may be appointed. The Secretary of War shall impose upon the company any rules and regulations that shall prevent injury to navigation whenever in his opinion such injury is being done.

The final section of the Act directs the Secretary of War to make preliminary examinations or surveys at 152 localities in 37 States, of which a list is given.

Preliminary arrangements for carrying out the provisions of the River and Harbor Act have been completed by Gen. Gillespie, Chief of Engineers U. S. A., and the engineer officers in charge of the different districts have been directed to submit as soon as practicable "projects for the expenditure of the amounts appropriated specifying in each case to what part of the work it is proposed to apply the funds, reference being had to the approved plan and to the estimate upon which the present appropriation is based." The organization of the boards of engineer officers for the execution of certain parts of the Act has been completed by Gen. Gillespie, and is as follows:

For improving the waterway at Norfolk, Va.—Col. P. C. Hains, Lieut. Col. Charles J. Allen and Maj. James B. Quinn.

For improving Sandy Bay, Cape Ann, Mass.—Col. C. R. Suter, Lieut. Col. W. S. Stanton and Maj. S. W. Roessler.

For improving Upper Hudson River, New York.—Col. S. M. Mansfield, Maj. W. J. Marshall and Lieut. F. H. Schulz.

For improving the waterway at Lockport, Ill.—Lieut. Col. O. H. Ernst, Lieut. Col. C. J. Allen and Maj. Thomas L. Casey.

Improving the Columbia River between the foot of the Dalles rapids and the head of Celilo falls.—Lieut. Col. W. H. Heuer, Maj. W. L. Marshall and Capts. Edward Burr, C. F. Gillette and C. H. McKinstry.

For improving the waterway at Puget Sound.—Lieut. Col. W. H. Heuer, Capt. W. C. Langfitt and Lieut. R. P. Johnston.

For canal and locks and Willamette Falls.—Maj. John Mills, Capt. W. C. Langfitt and Lieut. R. P. Johnston.

Improvements at Galveston and Trinity River, Tex.—Lieut. Col. H. M. Adams, Maj. G. Mc. Derby and Capt. W. V. Judson.

Improvements at mouth of Columbia River.—Maj. W. L. Marshall and Capts. C. E. Gillette and C. H. McKinstry.

English and American Railroad Rates.

Mr. George S. Gibb, the General Manager of the North Eastern Railway, has written the following letter to the *Times* upon English and American railroad rates:

"Will you let me prick a bubble in your columns? At least, I think it is a bubble.

"American railroad rates, people say, are lower than English railroad rates.

"That the average rate per ton per mile for all goods traffic carried on American railroads is lower than the average rate on English railroads is indisputable. But this general and true statement is converted in many minds into an incorrect belief that English railroads charge more for services they actually perform than American railroads charge for similar services.

"The average rate per ton per mile on all traffic carried is a misleading figure. If one is in search of bare truth, one must examine the component parts of the average. The American average is reduced by the inclusion of rates on large quantities carried for very long distances, a kind of traffic that does not exist in England in proportions large enough to affect the average. It must also be remembered that a large percentage of English rates include, whilst all American rates exclude, the services of collection and delivery.

"The only sound way to make a comparison is to take concrete instances, and to show by them what is charged on an English railroad for a specified quantity of any commodity carried for a specified distance, in comparison with the American railroad charge for a similar quantity of similar traffic carried for a similar distance.

"American traders send their traffic in large consignments; English traders do not. I have more than once asked individual traders whether a large-quantity rate would be useful to them, but have invariably been discouraged from further conversation by their replies. Yet the same people on festive occasions thump the table to the theme that the difference between English and American rates constitutes an oppression of English trade.

"The fact is, that for the quantities in which English traders actually consign their traffic, and for usual English distances, English rates are lower than American.

"I will give definite illustrations of my assertion, which I have carefully verified by personal investigation, and my illustrations will be drawn from one of the largest railroad corporations in the Eastern States of America and from the North Eastern Railway in England.

"The following table gives the rates per ton for conveyance of a consignment of five tons of the undermentioned articles (excluding collection and delivery), carried between two stations 42 miles from each other:

Article of Merchandise.	American rate.		English rate.	
	s.	*d.*	*s.*	*d.*
Bricks (common)	12	2	4	6
Cement	8	5	5	10
Flour in sacks	7	6	6	8
Malt in bags	7	6	7	1
Oilcake	7	6	6	8
Potatoes in bags	8	5	6	8
Plates and bars (iron and steel)	8	5	5	0
Stone (rough) (building)	8	5	4	2
Ale	12	2	10	9

"These figures represent actual charges on the usual scale, not exceptional rates. I have selected a distance slightly in excess of the average haul for all goods traffic

carried on the North Eastern Railway, viz., 35½ miles, as I am anxious not to overstate the case, but the differences would have been more in favor of the English rates if shorter distances had been taken. For example, the rate for five tons of bricks on the American railroad for a distance of 21 miles is 8s. 5d., as against 2s. 9d. on the North Eastern.

"The list might be extended indefinitely, but it is better to make it short, clear, and definite."

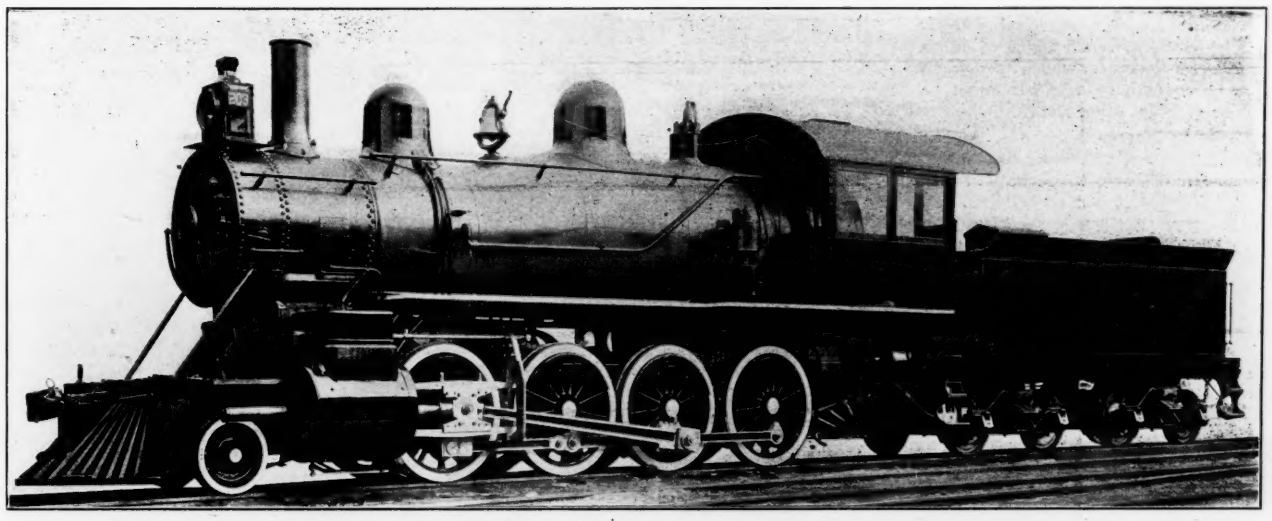
Compound Consolidation for the Wheeling & Lake Erie.

The consolidation engine shown in our illustrations was built at the Pittsburgh shops of the American Locomotive Co., and weighs 83½ tons. Its tractive power is 35,000 lbs., the cylinders being 22 and 33 x 28 in. The valves are Richardson, balanced. The boiler is of the extended wagon top type, with horizontal seams, butt joint, double welted, and sextuple riveted, while the circumferential seams are double riveted. Three 3-in. Ashton pops are used, and the water is supplied by two No. 10 Ohio injectors. The tender trucks are of the diamond pattern, and are equipped with the American Steel Foundry Co.'s bolster. The draw gear used at the back of tender is the Westinghouse friction gear with M. C. B. coupler head. The principal dimensions of this engine are given below:

Weight on drivers	146,300 lbs.
Weight on truck wheels	21,100 lbs.
Weight total	167,400 lbs.
Weight of tender, loaded	84,300 lbs.
Weight total of engine and tender	251,700 lbs.
Wheelbase, total of engine	23 ft. 10 in.
Wheel base, driving	15 ft. 8 in.
Wheel base, total of engine and tender	52 ft. 3⅜ in.
Length over all, total, engine and tender	62 ft. 6 in.
Height, center of boiler above rails	8 ft. 6¼ in.
Height of stack above rails	14 ft. 10 in.
Heating surface, fire-box	159 sq. ft.
Heating surface, tubes	1,849 sq. ft.
Heating surface, total	2,008 sq. ft.
Grate area	30 sq. ft.
Drivers, diameter	57 in.
Drivers, material	Cast steel
Truck wheels, diameter	30 in.
Journals, driving	8 x 11 in.
Journals, engine truck	5½ x 10 in.
Main crank pin, size	6¼ x 7 in.
Cylinders, diameter	22 and 33 in.
Pistons, stroke	28 in.
Piston rods, diameter	4 in.
Steam ports, length	H.P. 18 in. L.P. 21 in.
Steam ports, width	H.P. 1⅝ in. L.P. 2 in.
Exhaust ports, length	H.P. 18 in. L.P. 21 in.
Exhaust ports, width	H.P. 3 in. L.P. 3½ in.
Bridge width	1½ in.
Valves, greatest travel	H.P. 5 in. L.P. 6 in.
Valves, outside lap	H.P. 1 in. L.P. ¾ in.
Valves, inside clearance	H.P. ⅜ in. L.P. ½ in.
Valves, lead in full gear	H.P. 1/16 in. L.P. 3/32 in.
Boiler, type of	Extended wagon top
Boiler, working pressure	200 lbs.
Boiler, material in barrel	Carbon steel
Boiler, material in barrel, thickness	11/16 in.
Boiler, diameter of barrel at front sheet	60 in.
Boiler, diameter of barrel at throat sheet	70⅛ in.
Thickness of tube sheet	½ in.
Dome, diameter	30 in.
Safety valves	Three, 3-in. Ashton pops
Crown sheet supported by radial stays	1⅛ in. diameter
Tubes, number	260
Tubes, outside diameter	2 in.
Tubes, length over tube sheet	13 ft. 8 in.
Tubes, material	Franklinite iron
Fire-box, length	108 in.
Fire-box, width	40¼ in.
Fire-box, depth at front end	67¾ in.
Fire-box, depth at back end	64½ in.
Fire-box, material	Carbon steel
Fire-box, thickness of sheets, crown	7/16 in.
Fire-box, thickness of sheets, sides and back	⅜ in.
Fire-box, thickness of sheets, tube	½ in.
Fire-box, water space; width; front, sides and back	4 in.
Exhaust nozzle, diameter	5¾ in.
Smokestack, least diameter	15 in.
Smokestack, greatest diameter	16 in.

Tender.

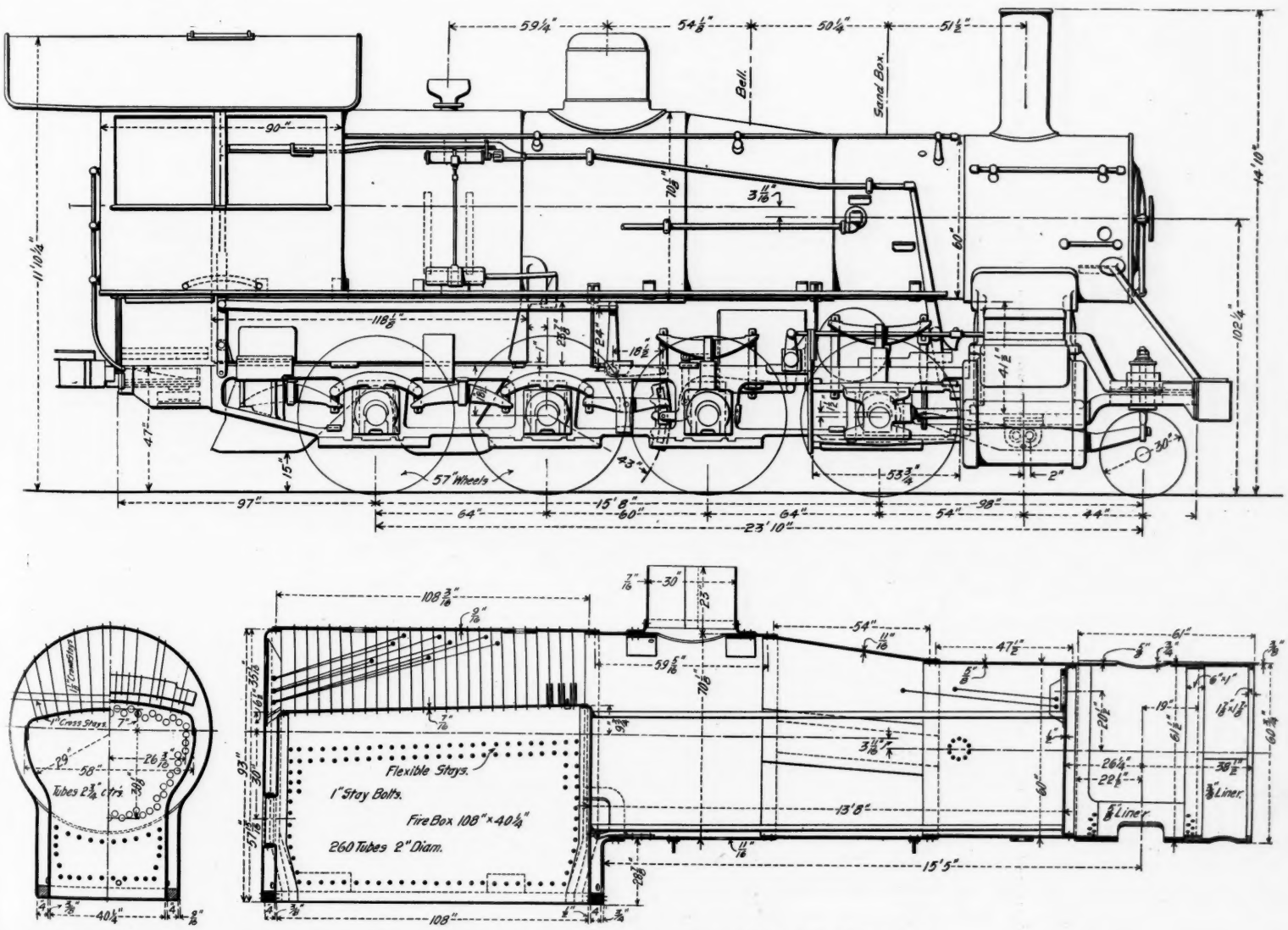
Tank, capacity, water	4,000 gallons
Tank, capacity, coal	8 tons
Type of under-frame	Wood



Compound Consolidation Locomotive of the Wheeling & Lake Erie.

Built by the AMERICAN LOCOMOTIVE COMPANY, *Pittsburgh Works.*

The Russians are prosecuting the work on the Orenburg & Tashkend Railroad with great energy. About 10,000 men are employed in grading and bridge construction on the 400 miles from Tashkend northwestward. The route lies so far from the old post road, which has been traveled for ages, that a new highway has been built for use during construction. It is an arid country, and doubtless a passable road can be made without much work.



Compound Consolidation Locomotive, Wheeling & Lake Erie Railroad.

TECHNICAL

Manufacturing and Business.

The Norfolk & Western has specified Damascus brake-beams on 500 cars building at the Middletown Car Works.

Harry A. Norton, of Boston, Mass., sailed on July 2 for an extended trip to visit the various European agencies for the Norton ball-bearing jacks, the foreign demand of which has largely increased.

The American Railway Switch Company has recently been incorporated with $500,000, to make frogs, switches, curved rail castings and special railroad track. Geo. A. Ricker, of Buffalo, is President and General Manager.

Pawling & Harnischfeger, Milwaukee, Wis., state that the demand for electric cranes and hoists remains highly satisfactory. They advise that present booking of orders is on the average of one crane per day, which fully equals their works capacity. The foreign demand is bettering, judging by the inquiries within the last month.

G. P. Altenberg, Foreign Manager of the J. A. Fay & Egan Co., of Cincinnati, Ohio, makers of wood-working machinery, has gone to Europe, where he will visit the principal countries in the interest of his firm. He will also go to South Africa to organize agencies. The address of Mr. Altenberg while in Europe will be 51 Wharton Road, Kensington, London, W., England.

The Industrial Works, of Bay City, Mich., one of the great manufacturers of railroad cranes, will shortly install a large amount of additional electrical apparatus. A recent purchase from the Westinghouse Electric & Mfg. Co. includes a 150 K.W., direct-current generator, which will be used to furnish current to 18 or 20 direct-current motors already in use in the plant, a 200 K.W., two-phase alternator, and a number of induction motors. The alternating current apparatus will be used entirely for power distribution.

The American Steel & Wire Co. received a long list of awards at the South Carolina Inter-State and West Indian Exposition as well as the Diploma of Merit for its installation in the Commerce Building. The list, in part, is as follows: Merchants iron and steel, cold drawn steel shafting, wire nails, rail bonds, wire rope, machinery and appliances for drawing wire, springs and spring wire, copper, iron and steel, and aluminum wire, each of which received a gold medal; underground and overhead wires and cables, metallurgy of zinc, receiving silver medals; and coal and coke, receiving bronze medal. These medals represent the highest awards in each class.

D. L. Markle, who has for the past five years been connected with the Illinois Car & Equipment Co. in the capacity of Assistant Manager and Purchasing Agent, has been appointed General Manager of the Western Steel Car & Foundry Co. His office will be removed to Hegewisch, Ill., and his duties, in addition to general management details, will comprise personal supervision of the plant at Hegewisch, and also the purchasing of all material. Mr. Markle's experience in the car building business covers a period of 10 years, in which time he has acted in various capacities from shop clerk to the duties of the office to which he is just appointed. He is 35 years of age and by constant application to details of car building has gained a creditable reputation among railroad and car men.

An order was entered in the United States Court at Springfield, Ill., on June 30, discharging Walter C. Arthurs as Receiver for the Mt. Vernon Car Manufacturing Co., of which he has had charge in that capacity since January, 1897. Comparative financial statements for the beginning and end of the period of receivership show the affairs to have been very ably administered. The assets of the concern in January, '97, were $262,-991.84, and the liabilities $144,597.40. It is turned back to the stockholders having assets of $821,213.74 and liabilities of $303,318.17. In addition to this, over $30,000 in bad debts was charged off and about $50,000 was spent on the plant, increasing its capacity to 20 cars a day. The business will be continued by the old company with the following as officers: D. O. Settlemire, President; W. C. Arthurs, Vice-President and Treasurer; Ralph K. Weber, Secretary; Frank Snyder, Superintendent; G. G. Gilbert, Attorney.

Iron and Steel.

Edward A. Muench, Chief Purchasing Agent of the United States Steel Corporation, died at his home in Overbrook, a suburb of Philadelphia, last week.

All the unskilled employees of the Carnegie Steel Co., nearly 15,000, have had their wages increased 10 per cent. This will make the wages of the lowest $1.65 a day. Tonnage men and men working under a scale are not affected.

The Victorian Government Railroad is calling for bids, returnable September 1, for 15,850 tons steel rails and 1,505 tons steel fish plates. The rails are 8,500 tons of 80 lbs. and 7,350 tons of 100 lbs. Particulars can be had from the agent general's office, London.

Officers of the Illinois Steel Co. have applied to the Secretary of State for articles of incorporation for a new savings bank at South Chicago, the officers of which will be representatives of the steel company. It is said E. H. Gary, Chairman of the Board of Directors of the United States Steel Corporation, will be interested.

In the month of June the Baltimore & Ohio hauled from Fairport 230,098 tons of ore, which is said to be the largest tonnage for a single month ever hauled from that port. Most of the ore was delivered to the Pittsburgh District, although much went to the furnaces in the Shenango and Mahoning valleys and at Sparrows Point.

The Pennsylvania R. R. announces that its orders for rails for 1903, on all lines both east and west of Pittsburgh and Erie, will amount to 207,000 tons. Contracts have been made and the orders distributed as follows: United States Steel Corporation, 110,000 tons; Cambria Steel Co., 38,500 tons; Pennsylvania Steel Co., 38,500 tons; Lackawanna Iron & Steel Co., 20,000 tons.

The Raritan Structural Steel Co. was incorporated in the State of New Jersey July 2 with a capital of $300,-000 by Charles F. Terney, Winfield S. Thorp and Julian N. Pinkney, all of whom give their addresses as No. 227 Townsend street, New Brunswick, N. J. The charter of the company is a broad one, permitting it to engage in all branches of the iron and steel business.

According to despatches from London, the returns for the six months just ended showed the production of all classes of manufactured iron in the north of England district to be the smallest recorded in the history of the trade. The total was 41,900 tons, compared with 46,200 tons for the same period of 1901. Compared with 1899, this year's output shows a diminution of 51 per cent.

The Iron Age in its issue of July 3 says: So far as the immediate supply of pig iron is concerned, the situation is becoming more and more serious, and is affecting more particularly the foundry trade. The Schuylkill and Lehigh valleys are crippled by the anthracite coal strike, and are not getting their supply of mountain cokes as fast as they ought to. In Virginia a number of stacks are idle, owing to the troubles in the Virginia and West Virginia coal fields, which are also causing cessation of work with the blast furnaces of the Ohio valley. Some of the Tennessee furnaces are in trouble, too, and now comes the struggle over the renewal of the scale with the miners in the Birmingham district, which has already caused the banking of six blast furnaces in the district. The steel trade is not affected as to supply of raw material, except so far as it tells on the make of basic pig and low phosphorus iron.

New Tool Company Organized.

The Bayldon Machine & Tool Co. was incorporated in New Jersey, June 24, with a capital stock of $10,000. It is understood that the organizers propose to increase the capital stock later on. The incorporators are Frank W. Hedden, Jersey City; Myron N. Kent, Irvington, N. J., and George F. Fish, Philadelphia. The charter of the company permits it to make all kinds of tools.

The German Speed Experiments.

The experiments on the Berlin Military Railroad to ascertain the highest attainable railroad speeds have been resumed. They were suspended about the end of last year in order that the track might be strengthened. At that time the highest speed attained had been 99.6 miles per hour. Meanwhile Siemens & Halske have built a locomotive from the designs of their Chief Engineer Reichel, with which they hope to attain still greater speed and effectiveness. It will receive directly a current of 10,000 to 12,000 volts without transformation. It is to haul an entire train of cars. At first experiments will be made with the locomotive alone.

The Siberian Railroad—The Baikal Line.

The Russians are having great trouble in finding a practicable route around the south end of Lake Baikal to unite the completed sections of the Siberian Railroad. Surveys have been prosecuted for four years and four different routes located. Recently it was said that the line likely to be selected followed the lake shore closely, and would have to be blasted out largely on the face of overhanging cliffs, at an average cost of about $200,-000 per mile. Now comes a report that a line much further inland has been chosen; and some 60 miles of it will be in the bed of the mountain stream Irkut, which at this distance from its mouth will be turned from its northwest course through a channel to be cut eastward across a low summit into a little stream emptying directly into Lake Baikal, which is there only about 12 miles distant.

The Simplon Tunnel.

Machine-drilling was resumed on the south end of the Simplon Tunnel May 20, after having been suspended 7½ months on account of the mighty vein of water tapped there. In this time the penetration effected at that end was only 82 meters, while in the last 12 days in May with the machine drills the advance was 68 meters. On the north end in May the advance was 201 meters. There remains a distance of about five miles between the two headings.

Stanley Electric Manufacturing Company.

The Stanley Electric Mfg. Co. has filed papers with the Secretary of State at Trenton, N. J., increasing its capital stock from $10,000 to $4,000,000, for the purpose of enlarging the plant at Pittsfield, Mass., and to extend the scope of its business in the manufacture of electrical supplies. A report says that there is a likelihood that the Electric Storage Battery Co., which is owned by the Widener-Elkins-Whitney syndicate, will absorb the Stanley Electric Mfg. Co., the absorption to take place in the early autumn.

New Block and Interlocking Signals.

The New York Central & Hudson River has awarded a contract to the Hall Signal Company for the equipment of its Putnam Division, from 155th street, New York city, to Yonkers, eight miles, with Hall automatic electro-gas block signals, to be operated on the normal danger plan. There will be a home and a distant signal on each post. There will be about 20 signals in all, the length of the block sections being about 4,500 ft. Many suburban trains are run on this line.

The Central is putting in an extensive electric pneumatic interlocking plant at Albany for the signaling of the yard at the passenger station. This is a through station, and there are eight tracks from one end to the other. There will be a tower at each end of the yard, and another at Broadway. The Delaware & Hudson is to have a low-pressure pneumatic interlocking plant near this station, on the north, and compressed air for both these plants will come from the same compressor. The New York Central plant will be finished in about two months.

The Central has lately completed mechanical interlocking plants at a number of points on the Mohawk Division, Albany to Syracuse. These interlockings cover all four main tracks in each case, and provide crossovers for all of them, the machines having in most cases from 36 to 40 levers. The plants most recently completed are those at tower No. 9 west of Schenectady; Tribes Hill, Herkimer and Ilion. One at Oneida is now under construction; also one at Greenway, and one at the east end of the Utica yard. With two exceptions the groups of switches on this division are now all interlocked, or will be as soon as the plants here mentioned as unfinished are ready to be put into service. Outlying switches are controlled by electric locks connected with the cabins.

A large amount of interlocking work is being done on the Western Division between Rochester and Buffalo. All of the above mentioned work, except that at Albany, is being done by the railroad company's men.

Water Softening.

The Delaware, Lackawanna & Western Railroad has awarded a contract to the Pittsburgh Filter Mfg. Co. for two water softening plants of the intermittent type for the Buffalo Division. These plants will each have a daily capacity of 200,000 gallons, and will be on ground adjacent to the existing pumping station. The work will be completed in about 45 days.

Consolidation of Great Lakes Shipbuilding Concerns. Advices from Cleveland, Ohio, state that a movement is on foot to consolidate all the independent shipyards on the Great Lakes where steel vessels are built and repaired. These are said to include the Craig Shipbuilding Co., Toledo; Empire Shipbuilding Co., Buffalo; Columbia Engineering Works, Marine City, Mich.; Burges & Burges, Manitowoc, Wis.; Jenks Ship Co., Port Huron, and the Shipowners' Dry Dock Co., of Chicago.

The Locomotive Machine Company of Montreal.

The Locomotive Machine Co. of Montreal has recently been incorporated with $1,000,000 capital, by Michael John Haney, of Toronto; James Thomas Davis and Michael Connolly, of Montreal; G. P. Brophy, of Ottawa, and Roger Miller, of Ingersoll, all contractors, to conduct a foundry, machine shop, engine, structural, boat and bridge building establishment.

International Steam Pump Company.

The statement of operations for the year ended March 31, 1902, just issued, shows net profit of $1,510,486. The surplus, after dividends are paid, will be $734,436; the total undivided profits, including previous surplus, being $2,227,904. No profit has been added for work in progress. The current assets amount to $6,634,490. The balance sheet of the International Steam Pump Co. proper shows total assets of $28,693,122. The "consolidated" balance sheet shows total assets of $31,765,657 and a surplus account of $3,614,417. This latter amount and the sum of $2,227,905 credited to undivided net profits as given above is mainly accounted for by the accumulations of undivided profits of the various associated companies, which had accrued prior to their association with the International Steam Pump Co. and which are not, therefore, considered to be available as undivided profits of that company. President John W. Dunn says the orders on hand at the present time are largely in excess of the capacity of the works, which, during the year, were taxed to their utmost. During the year just closed the orders taken have been over 41 per cent. in excess of the orders taken during the preceding year. It has been found necessary to substantially enlarge the plants. Additions have been made to some of the shops and the erection of extensive new works has been begun at Harrison, N. J., for the Worthington Co., which, it is intended, shall be the largest and best equipped pump manufacturing plant in the world. There has been bought during the past year the Clayton Air Compressor Works. The outstanding 40 per cent. of stock of the Holly Co., except a small number of shares, has also been acquired in the process of reorganizing the affairs of the company.

Signaling Notes.

An all-electric interlocking plant has just been put in operation at Marion Junction, Ohio. This junction is traversed by the trains of the Cleveland, Cincinnati, Chicago & St. Louis, the Erie, the Hocking Valley, and the Columbus, Sandusky & Hocking.

The Lehigh Valley is using Dodson lamps on some of its signals between Sayre and Van Etten.

Brake-Shoes.

A new brake-shoe company, recently incorporated in Illinois, with a capital of $100,000, has the name of the Economy Brake-Shoe Co., the following being its officers: Edward S. Marshall, President; Albert Waycott, Vice-

President and General Manager; F. F. Rose, Secretary. The purpose of the company is to manufacture high grade insert brake-shoes.

THE SCRAP HEAP.

Notes.

The State Railroad Commissioners of Louisiana have refused to authorize steamboats on the Mississippi River to advance rates on sugar and rice from Bayou Lafourche to New Orleans. Certain railroad companies join in the application. The same Commission, according to a local paper, has imposed a fine of $2,000 on the Cumberland Telephone & Telegraph Co., for overcharge on a three-minute conversation between Gibson, La., and New Orleans.

On the night of July 3 passenger train No. 5 of the Chicago, Rock Island & Pacific was stopped by robbers near Dupont, Ill., and one of the safes in the express car was opened, after a fight with the messenger. The messenger was wounded by a pistol shot. When the passengers began to swarm out of the cars to learn the cause of the shooting, the robbers became frightened and fled. It is said that the robbers did not get much booty, and that they missed $100,000 which they might have taken.

The Fire and Police Commissioners of the city of Memphis, being in a public spirited mood the other day, passed, in the space of a few minutes, a resolution requiring the railroad companies owning lines in that city to erect and put into operation within 60 days substantial and approved gates, at the crossings of about 60 streets. The Illinois Central is directed to put up gates at 17 streets, the Iron Mountain at 14 streets, the St. Louis & San Francisco at one, the Southern Railway at seven, and the Louisville & Nashville at 20 or more.

At Cincinnati on July 8 the United States Court of Appeals affirmed the judgment of the lower court in the case of the Central Stock Yards Company, of Louisville, against the Louisville & Nashville road, holding that the road could not be compelled, under the provisions of the Kentucky constitution, to accept stock from points outside of Kentucky for delivery to the Central Stock Yards, in Louisville, located on the line of another railroad. Judge Day, in delivering the opinion, said if such power was claimed for the Kentucky constitution it would be regulating interstate commerce. This it could not do.

The Noel primary election law of Mississippi changes the mode of nominating and electing the three railroad commissioners. Under the code of 1892 the railroad commissioners, while each must come from a given district, were nominated by the State at large and elected by the State at large. The railroad commissioner districts are the same as the Supreme Court districts, northern, middle and southern. Under the new law railroad commissioners are nominated by districts, but elected by the State at large. In other words, the electors in each of the districts nominate a man for railroad commissioner for that district, and the people of the entire State are required to elect the three commissioners nominated separately by districts. So that every elector in Mississippi, it will be seen, must vote for two railroad commissioners in whose nomination they have had no hand and who may be entirely unknown to them.

The Northbound Cattle Movement.

During the past two months the Burlington has handled thousands of cars of cattle from the sun-parched ranges of Texas to the northwest. A Denver paper says that this is the greatest movement of Texas cattle to the plains of Montana and British Columbia ever known. "Up to noon yesterday the Colorado & Southern had hauled to Denver and turned over to the Burlington 4,003 cars of cattle from Texas. The Burlington took these cars through to Billings. There are 700 more cars to be shipped. Each car will contain 50 yearlings or 37 two-year-olds. Some of the cattle are driven as far as 600 miles onto the ranges of British Columbia, but the majority of them have gone to the Montana plains, ranging from the British Columbia line to the Missouri and along the tributaries of the Missouri River. One firm alone has shipped 40,000 cattle and Col. Hughes, of Denver, has shipped 25,000 head. The transportation of these cattle has drained the Colorado & Southern roads of cattle cars and has compelled the running of solid trains of empty cars from Billings to points in Texas."

Fast Time on the Pittsburgh Division.

What was probably the best long-distance run ever recorded by the Pennsylvania Railroad was made yesterday with No. 11, the St. Louis fast mail train, due here at 12:20 p.m. Engineer T. W. Masterson covered the Pittsburgh Division, from Altoona to Pittsburgh, 117 miles, in 125 minutes (including a delay of 19 minutes) with one of the new E-2 type engines, No. 2016. The train of three cars was 13 minutes late at Altoona and lost 19 minutes on this side of Altoona by unavoidable delays, and still arrived at the Union station on the dot, making up 32 minutes of lost time, and the Pittsburgh Division is one of the most difficult over which this fast train has to travel. From Gallitzin to Pitcairn, the distance of 90.8 miles was covered in exactly 86 minutes; Gallitzin to Wilkinsburg, 99.3 miles, 99 minutes.—*Pittsburgh Post*, July 8.

Rules for Handling Foreign Cars Under the Per Diem Plan.

Mr. M. J. Daly, Superintendent of Transportation of the Illinois Central, has issued to the agents of the road elaborate instructions for dealing with foreign cars under the new arrangement. From these instructions we quote a few paragraphs:

Under the per diem method of settlement cars will be interchanged between the different roads more freely than in the past. We will, however, require agents at junction points to transfer foreign cars when delivered us when we have a surplus of our own equipment and when the commodity tendered will permit of transfer without damage, that are destined to stations on our own line for unloading. Foreign cars tendered us by connections, destined to points on other foreign roads will at all times be accepted and run through to be delivered to connecting road without transfer by us.

The car hire expense each month will be compiled in the Car Accountant's office, in order to show, first, the efficiency of the station service; second, the efficiency of each division organization.

When foreign cars are available and can be loaded promptly to points on or via the road owning the car, they must be so utilized; they should not, however, be held awaiting shipments.

When Illinois Central System cars are available, foreign cars must not be used in local service, even in direction of the home junction; the foreign car must be sent home empty and Illinois Central cars used to protect the local traffic.

During a scarcity of cars it will always be proper to use foreign cars to load locally in direction of the home junction, when it is also the direction of heavy traffic.

When a shortage of cars exists it will be proper to load foreign cars in direction of home, or to send them empty in the opposite direction to secure a load to or via the home road, and foreign cars delivered us in switching service, during busy season, when made empty must be reported on No. 9 report each day to the Trainmaster, in order that he may utilize them when necessary at other stations to load to points on or reached via the road owning the cars.

A penalty charge of 80 cents per day, in addition to the per diem, shall be paid for each day after a car has been on our rails 30 consecutive days. To protect against this penalty, agents must examine date on new form of home route cards attached to the end of the cross-tie or needle beam under side door of car, and when such date shows the car to have been in our possession 25 days agents or yardmasters will make special report of this car to the Trainmaster, in order that he may secure the release and return of the car prior to this penalty charge becoming effective.

When foreign cars have been in our possession 25 days or more, they must be slip-billed home on form 151 and the waybill marked "Special," and such cars must not be stopped in transit for loading, but be permitted to go direct to the road billed to, except in case we are short of cars, and such cars can be loaded home to or via the road owning the car without materially delaying it over the 30-day limit.

Professor Johnson's Books.

We learn that Professor Johnson had some time ago made arrangements to have Prof. F. E. Turneure (University of Wisconsin) to carry on the revision of his books in case of his death or disability, consequently we may expect that these will be kept up to the requisite standard. As we have said before, a chapter on Steel Concrete Construction will be added to the next edition of Johnson's "Framed Structures." There is practically nothing on this subject in any of the text-books. The book on "Engineering Contracts and Specifications" was undergoing serious revision at the time of Professor Johnson's death, but practically all of the material for the revision had been collected.

Ship Yard Notes.

The Norfolk & Hampton Roads Shipbuilding & Dry Dock Company will meet in Norfolk July 6 for the purpose of organization. C. W. Tebault is the chief promoter, and among the members of the company are: D. Lowenberg, of Norfolk; ex-Governor Atkinson, of West Virginia, and Secretary of State Peter Silman, also of West Virginia. The company is capitalized at $10,000,000 and has secured options on property on Hampton Roads to be used for an extensive shipbuilding plant.

The John Roach shipyard at Chester, Pa., on the Delaware River, has been sold to the Delaware River Ship & Engine Building Co., which has $5,000,000 capital and $2,500,000 bonds.

Osborn Congelton, President of the American Elevated Railroad Company, Philadelphia, is reported as saying that he, with others, is about to launch a new Delaware River steel company, which will turn out shipbuilding material for the Roach yard in Chester. The Delaware River Steel Works, according to Mr. Congelton, will shortly be incorporated in New Jersey, with a capital stock of $3,000,000.

The William G. Fitzgerald Marine Engineering Company will soon be incorporated by Charles Griffith, T. W. Jenkins, J. Maulsby Smith, W. G. Reed and William G. Fitzgerald. The works will be at the corner of Allen and Clement streets, adjoining W. E. Woodall & Co.'s shipyard, Baltimore, Md., where a plant is already installed to which additions will be made.

Kern River Power Canal.

The Kern Power Co. (California) has begun work on a canal 12 miles long which will furnish 30,000 miner's inches of water to its new power plant. An electric transmission line 110 miles long will deliver 15,000 h.p. in Los Angeles which will be utilized by the Huntington-Helman Street R. R. system and also the suburban lines.

Main Items Through the Canals at the Soo.

May, 1902.—Copper, net tons, 14,311; grain, bushels, 1,232,436; flour, barrels, 913,034; iron ore, net tons, 2,966,261; wheat, bushels, 9,352,243; coal hard, net tons, 52,293; coal, soft, net tons, 637,615; freight, eastbound, net tons, 3,632,885; westbound, net tons, 792,774; total freight, net tons, 4,425,659; vessel passages, number, 2,925; registered tonnage, net tons, 3,953,165.

June, 1902.—Eastbound: Copper, net tons, 16,834; grain, bushels, 615,593; flour, barrels, 1,055,267; iron ore, net tons, 3,348,261; lumber, M. ft. B.M., 152,668; wheat, bushels, 5,636,972. Westbound: Coal, hard, net tons, 6,646; coal, soft, net tons, 654,214; manufactured iron, net tons, 22,160; salt, barrels, 70,051; general merchandise, net tons 84,405. Freight: Eastbound, net tons, 3,944,004; westbound, net tons, 777,604; total freight, net tons, 4,721,608; vessel passages number, 3,149; registered tonnage, net tons, 4,257,340.

Low Lake Rates on Wheat.

Wheat freights from Duluth to Buffalo by lake are now 1 cent a bushel. This is lower than in many years. It means but 33 cents a ton, gross, and there is to be deducted from every ton the cost of trimming and unloading, which is about 15 cents. The distance is about 1,000 miles.

The freight is, therefore, one-third of a mill per ton per mile, gross. This is about a tenth of the cost on the best freight roads in the country. This rate is not profitable, and none but line boats that must move anyway and have package freight to carry, are taking stuff under it. The drop in rates is due to the excess of new tonnage on the lakes this year and to the decrease in grain for shipment.

This rate is especially notable by reason of the fact that iron ore, the customary basis for all lake freight rates, remains solidly pegged at 75 cents a gross ton, twice as high. Iron ore remains so high because the United States Steel Corporation refuses to take advantage of the situation, and, having won a victory from vessel owners at the commencement of the season by cutting the rate from 80 to 75 cents, prefers to hold the latter price, and show its willingness to give and take, rather than, having forced one reduction, to take another and more radical one. In other words, the Steel Corporation is trying, in lake transportation, as in the price of ore and steel, to steady and preserve the market situation. Lake freights have always been the most unsteady factor in the entire Northwestern industrial situation, as the present grain rate testifies.—*New York Times.*

The Commission Upheld.

A press despatch from Macon, Ga., says that Judge Speer, in the United States Court, has affirmed the order of the Interstate Commerce Commission directing the Louisville & Nashville, and other roads, to reduce the rates on cotton and naval stores from Florida points to Savannah. The rate of $3.30 a bale, on cotton, was ordered reduced to $2.75; this is to remove an inequality, as compared with other ports, from which Savannah has suffered. Judge Speer says:

"The discriminations against Savannah are practically admitted by the respondents. The sole justification relied upon is the promotion of the interest of the Louisville & Nashville by building up a near-by port, and further by securing the long haul from Pensacola toward the northwest. But considerations of this character cannot justify rates unreasonable and excessive and in violation of section 1 of the law. Nor can they justify rates unduly prejudicial to one locality and unduly preferential to another in violation of section 3 of the law. Nor has a railway company engaged in interstate and foreign commerce the right or authority to enact rates which are actually prohibitory to traffic in one direction without regard to the wishes of the shippers or the fair opportunity of a community thus prejudiced to promote its commercial prosperity. In all cases it must be regarded as true that discriminations made for the purpose of promoting the interest of the carrier are subservient to the interests of the general public and to the principles of justice in such matters sought to be attained by the purpose of Congress to regulate commerce. It is self-evident that rates which would give to producers and manufacturers on the Pensacola and Atlantic the competitive benefit of the Savannah market would be more conducive to their business and prosperity than rates which confined them to the Pensacola market, and while it is true that a carrier has the right to exact a fair return for the public utilities it affords, the public is entitled to exact that no more be required of it for the use of such utilities than the services rendered are reasonably worth, and where there is a plain and irreconcilable conflict between the interest of the public and the interest of the carrier the former must prevail."

New Army Barracks.

A special board of Army officers, of which Adjutant General Corbin and Quartermaster General Ludington are members, has been organized to report to the Secretary of War a general plan for the allotment of the appropriation of $3,500,000 contained in the Army appropriation bill for the construction of barracks at the different military posts.

The Metropolitan and the District.

The Metropolitan and the District Railways are now endeavoring to win back the traffic they have lost to the Central London, and to forestall further competition. The District has appointed as one of its directors Mr. A. L. Stride, the Managing Director of the London, Tilbury & Southend Railway, a company with which the District will in the future have close connections. Now that the Whitechapel and Bow extension line is completed, and the District is connected with the Tilbury, there is no reason why a good deal of traffic should not be carried, via the District, over the Tilbury to the East End of London, and to the docks in particular. Further, both the District and the Tilbury should secure an increased passenger traffic from the connection. The directors of the District have also elected Mr. Charles Spofford on the board. Mr. Spofford will represent large financial interests, and his American experience should prove of much advantage to the company. The Metropolitan has come to an agreement with the Great Western to electrify the joint line of the two companies to Hammersmith. Both the District and the Metropolitan announce a reduction in their fares between Hammersmith and Aldgate, the fares from July 1 being reduced to: Single—First, 6d.; second, 4d.; third, 3d. Return—First, 9d.; second, 6d.; third, 5d. The management hope by this reduction in fares to work on equal terms with the "Tube." Of course, the important matter with regard to both companies is that they should be electrified at the earliest possible moment, and we understand that the electrification of both companies is being proceeded with as rapidly as possible. —*The Statist.*

Mr. Ingalls' "Scrap-Pile" Won.

In an exciting race from Elkhart to Goshen, Engineer Jack Newton, running the locomotive hauling the afternoon Indianapolis bound Big Four train, beat the Twentieth Century Limited on the Lake Shore and afforded great sport for the passengers who, while the distance of 10 miles was being covered, stood on the platforms and exchanged greetings amid the greatest excitement. The Big Four locomotive is a scrap pile in comparison with the magnificent Twentieth Century train engine and the speed attained is regarded as wonderful.—*Indianapolis Sentinel.*

The Great Northern Shops at St. Paul.

Work has been under way for more than two months on the foundations for the new shops of the Great Northern at Dale and Minnehaha streets, St. Paul. The machine shop, which is 600 x 450 ft., will be ready for the heavy machinery in a few months. The next largest building is the boiler and blacksmith shop, which is 435 x 235 ft. The work of erecting walls for this building is now in progress. Two large storage houses are also to be built, one for light material and the other for heavy iron castings and machinery. The power plant, which will furnish heat, light and power for all the shops, will be a brick structure 105 x 100 ft. Exclusive of machinery and fittings, the new shops, it is said, will cost about $1,000,000. Electricity and compressed air are to be used largely as motive power. W. A. Truesdell is in charge of the work, assisted by M. J. Donovan and G. A. Johnson.

New Dry Dock at Seattle.

Moran Bros., ship builders of Seattle, Wash., will at once build a floating dry dock at their ship yard on Puget Sound, to cost $425,000. The dock will be 400 ft. over all, with a width of 100 ft. Electricity will be used as a motive power.

American Brains and English Bricks.

Mr. J. C. Stewart, the American contractor, whose record bricklaying performance in building the works

of the British Westinghouse Electric & Mfg. Company at Manchester, England, recently, caused so much discussion, has been engaged by the Midland Railway Company to supervise and expedite the work at the Midland Railway Hotel at Manchester. The contract is in the hands of Messrs. William Brown & Son, of Salford, England, and it is said that they are to receive $100,000 in bonuses if the work is finished within a year, and $10,000 a month for each month shorter than that time. The total price is $5,000,000.

The Borsig Locomotive Works.

June 21 the Borsig Locomotive Works in Berlin celebrated the completion of its 5,000th locomotive. These works were founded in the very early days of German railroads by August Borsig, a self-taught mechanic of extraordinary ability and force of character, and they are now managed by two of his sons. Some of the most eminent people in the Kingdom were present at the festival, including two Cabinet Ministers and an ex-Minister; also all the workmen in the shops, among whom was one who had worked with August Borsig in 1837 and is still employed by the firm. Indeed, the occasion was made memorable to the employees of the firm by the announcement that the brothers had added 250,000 marks to the "Louisa Borsig fund," for the benefit of the men, and had given 1,500,000 marks for a pension fund for the firm's foremen and officers—$416,500 in all.

LOCOMOTIVE BUILDING.

The Toledo & Ohio Central is reported to have ordered 10 locomotives for 1903 delivery.

The Stock Yards Co., Fort Worth, Texas, has ordered from F. M. Hicks two switch engines for use in its yards.

The East India Ry. has ordered 32 locomotives from Messrs. Borsig, of Berlin, delivery to be made in India within a year.

The Tennessee Central has ordered from F. M. Hicks two freight engines to be rebuilt by the Hicks Locomotive & Car Works.

The Hocking Valley has ordered 15 locomotives for 1903 delivery, 10 of which will be built at the Rogers Works, and five at the Brooks Works of the American Locomotive Co.

The Lake Shore & Michigan Southern is having 25 locomotives built at the Brooks Works of the American Locomotive Co., in addition to the order reported in our issue of June 13th.

CAR BUILDING.

The Gulf & Ship Island is building 500 flat cars.

The St. Louis & San Francisco is reported to be in the market for cars.

The Detroit Southern has ordered 500 coal cars from the American Car & Foundry Co.

The Shreveport & Red River Valley has ordered 100 box cars from the American Car & Foundry Co.

The Northern Pacific will, it is reported, build 60 refrigerator cars at its shops in North Tacoma, Wash.

The Vandergrift Construction Co. has ordered six motor car bodies from the American Car & Foundry Co.

The Glenfield & Western has ordered from F. M. Hicks 10 flat cars of 60,000 lbs. capacity rebuilt by the Hicks Locomotive & Car Works.

The New York, New Haven & Hartford, it is said, will order 17 cars for passenger service, five of which will probably be built in the company's shops.

The Central Vermont has asked bids on coal cars of 80,000 lbs. capacity, to be 30 ft. over end sills; width over all, 10 ft.; height, inside, 5 ft. 9 in., to be built of wood with wooden underframes.

The Colorado & Wyoming has ordered from the Barney & Smith Co. two coaches, 64 ft. long, 5 ft. 6 in. wide and 6 ft. 8½ in. high, with seats for 80 persons. It is not likely that any more coaches will be ordered for some time.

The Chicago, Burlington & Quincy has ordered 800 37-ft. gondola cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co. The special equipment includes Westinghouse air-brakes, Miner draft rigging and McCord journal boxes.

The Iowa & St. Louis order for 200 coal cars, placed with the American Car & Foundry Co., June 12, for September delivery and reported in our issue of June 20, calls for cars of 80,000 lbs. capacity. Length, 35 ft. 7 in.; width, 9 ft. 4 in.; height, 3 ft. 6½ in.; to be built of wood with wooden underframes. The special equipment includes Westinghouse air-brakes and Tower couplers.

BRIDGE BUILDING.

AKRON, OHIO.—Bids are wanted July 26 for a concrete steel arch bridge at Falor street. It is to be 43 ft. wide and have five arches 40 ft. 3 in. each. J. W. Payne, City Engineer.

ALLENTOWN, PA.—Local reports state that the proposed overhead bridge from the Tenth to the Sixth wards, either at Tilghman street or Allen street, will soon be built. The total cost will be about $50,000.

ALTOONA, PA.—Plans are being made for a highway bridge near the sewage filter beds. Harvey Linton, City Engineer.

CHICAGO, ILL.—The Drainage Board wants separate bids until Sept. 3 for the substructure and the superstructure of two Scherzer rolling lift bridges over Chicago River at Eighteenth street and at Loomis street. Thos. A. Smyth, President; A. R. Porter, Clerk.

CINCINNATI, OHIO.—The Miami & Erie Transportation Co. has asked the County Commissioners for permission to alter the Rose avenue, Cook avenue, Second street, Carthage street, Paddock Road and Edgemont avenue bridges.

DECATUR, GA.—Bids will be received until July 18 by Wm. Ragsdale for a 54 ft. steel bridge over Peachtree Creek.

EDINA, MO.—Bids are wanted July 14, 15 and 16 by Thomas Conway, Road and Bridge Commissioner, for three bridges to be built in Knox County.

FAIRFAX, WASH.—According to report, a new county bridge will be built across the Carbon River in the near future.

FORT PLAIN, N. Y.—Bids are wanted by Charles S. Boyd, Superintendent of Public Works, Albany, N. Y., for a bridge over Otaquago Creek.

FREDERICTON, N. B.—The Provincial Government is said to be asking bids for a bridge between the parishes of Canning and Johnson.

HOUSTON, TEXAS.—Plans are being made by the City Engineer for a viaduct over Montgomery avenue crossing to permit the Southern Pacific to lay four tracks on the avenue.

KANKAKEE, ILL.—The steel highway bridge spanning the Iroquois River at Sugar Island was washed away on July 1. The bridge was built last year and cost about $11,000.

MANILA, PHILIPPINE ISLANDS.—Bids are wanted until Aug. 1 by the Municipal Board of Manila, for a rolling lift highway bridge. A. L. B. Davies, Secretary.

NASHVILLE, TENN.—The Tennessee Central has decided on the location and details of the bridge to cross the Cumberland. It will be a three-span steel structure costing about $150,000. The total length will be about 650 ft., the draw span being 300 ft.

NORTH LOUP, NEB.—Bids are wanted July 15, according to report, for a 320 ft. bridge over North Loup River.

OTTAWA, ONT.—In regard to the Canadian Government rebuilding, strengthening or otherwise improving the bridges on the Intercolonial Ry., between Montreal and Levis, we are told that while this work is in contemplation for some time soon it will not be done this year.

PHILADELPHIA, PA.—Local reports state that the Director of Public Works will ask bids in a few days for the piers for the double rolling liftbridge over the Schuylkill River at Passyunk avenue. There is $50,000 available to begin this work.

PLAINFIELD, N. J.—The Union County Board of Freeholders has authorized two new bridges in Plainfield. One will be built on Berckman street at a cost of $3,000 and the other on Jackson avenue at a cost of $1,500. The plans for the bridges are completed and bids will be advertised for, so that work can be begun this month.

SAN JOAQUIN, CAL.—We are told that a steel bridge is proposed over the Mokelumne River by Commissioners of San Joaquin and Sacramento counties. The county clerks of each county may be able to give information.

SOUTH MOUNTAIN, ONT.—G. Steacy is said to be receiving bids for an iron bridge known as West's bridge.

ST. CLAIRSVILLE, OHIO.—The Board of County Commissioners wants bids July 24 for the sub-structure of a bridge on McMahon's Creek Pike.

SUFFOLK, VA.—The bids for a new bridge over Black Water River have been rejected by the courts and, according to report, new bids will probably be wanted.

TARA, ONT.—Bids are wanted July 12 for a steel bridge over Snake Creek in Bruce County. R. McDowell, Engineer in charge.

TOLEDO, OHIO.—The Wheeling & Lake Erie, we are told, intends to build 10 new bridges on its main line between Toledo and Wheeling, and three on the Steubenville Branch. Of these structures, nine will be new, the contract for which has been awarded to the American Bridge Co. Four of the bridges will be old bridges remodeled and strengthened.

In regard to the report that a liftbridge will be built over Swan Creek by the city, we are told that no legislation for such a bridge has been introduced in the Common Council. Legislation has been approved, however, to remove the old bridge and obstructions from Swan Creek at Lafayette street. It is not known whether a new bridge will be built or not.

VINCENNES, IND.—Bids are wanted July 12 by the Board of County Commissioners for three bridges. James D. Williams, County Auditor.

WAKEFIELD, ONT.—It is said that the township has voted to build a bridge over Gatineau River at the rapids in Wakefield, at a cost of about $9,000.

WILKESBARRE, PA.—Bids are wanted until July 26, at noon, for building five steel bridges and 30 stone bridges. Plans and specifications are at the office of the County Commissioners. Geo. R. McLean, County Comptroller.

Other Structures.

ALABAMA PORT, ALA.—The Gulf Coast, Ship & Marine Ways Co., according to report, will build a $20,000 plant for ship building and repairing. Joseph Espalla, Jr., & Co., 80 St. Francis street, Mobile, Ala., may be able to give information.

BALTIMORE, MD.—The Baltimore & Ohio has accepted plans for an iron pier at Locust Point to cost $600,000. It will form a part of the contemplated terminal improvements which the company purposes to erect at Locust Point at a cost of $2,000,000. The new structure will be 800 ft. long, 50 ft. high, 160 ft. wide, and have two decks, upon each of which tracks will be laid. The harbor will be dredged so as to give 32 ft. of water.

CALUMET, MICH.—Officers of the Copper Range R. R. are said to have selected a site in this city for a new station.

CANTON, OHIO.—It is said the United Steel Co., of Canton, will shortly be incorporated with $500,000 capital to build an open-hearth furnace at Canton to supply the Carnahan Tin Plate & Sheet Co., the Structural Steel Co., and other Canton enterprises with steel in various forms. Those chiefly interested are J. E. Carnahan, Edward Langenbach, Joseph Biechle, W. W. Irwin and W. M. Blecker. Work will be begun at once and the plant will be ready about March 1, 1903.

CEDARTOWN, GA.—It is probable that the Central of Georgia Ry. will build a roundhouse and shops at Cedartown on its Chattanooga Division, but this is not certain as yet.

COLUMBIA, TENN.—Superintendent Brooks, of the Louisville & Nashville, is said to be receiving bids on the new station to be built in Columbia. It will be a stone structure 154 x 30 ft., two stories high.

DES MOINES, IOWA.—The Rumley Mfg. Co. is having plans made for a machinery warehouse in this city to be 132 ft. sq. and cost about $50,000.

EVANSVILLE, IND.—Work on the new passenger station for the Louisville & Nashville has been begun. The new station will be of brick and stone and cost about $75,000. The general plan of the building will be that of an L, the arm along the tracks being 164 x 46 ft., and the other 150 x 45 ft.

GADSDEN, ALA.—The Alabama Consolidated Coal & Iron Co. will build another furnace at Gadsden at a cost of about $250,000. The stacks will be 95 ft. high and 19 ft. at the base, and will turn out about 200 tons per day. Most of the machinery has been ordered.

HALIFAX, NOVA SCOTIA.—The plant of the Londonderry Iron Works at Londonderry, N. S., was destroyed by fire July 7. The plant was owned by the Montreal Rolling Mill Co.

HARRISBURG, PA.—The committee that has in charge the building of the new capitol at Harrisburg will meet on July 9, when final plans will be considered. It is possible that bids will be shortly advertised for this work.

LOUISVILLE, KY.—It is reported that the Louisville & Nashville is preparing to begin work on its proposed general shops in South Louisville which, it is supposed, will cost nearly $1,000,000.

MANISTIQUE, MICH.—The Ann Arbor R. R., according to report, will build a freight and passenger station in this city.

MINNEAPOLIS, MINN.—The Minneapolis Steel & Machinery Co. will spend about $95,000 in improvements to the old harvester works in South Minneapolis, and in erecting new buildings.

MONTREAL, QUE.—A local report says that the Canadian Pacific has arranged for the immediate building of the proposed shops at Hochelaga. Our latest information was that the plans had not been approved.

MUNCIE, IND.—The Cleveland, Cincinnati, Chicago & St. Louis and the Wheeling & Lake Erie roads are said to have decided to consolidate their freight offices in a new building to be built at a cost of $50,000.

NILES, OHIO.—The Bostwick Steel Lath Co. is letting contracts for its new plant in this locality. The contract for the main building has been let to Smith & Hafer, of Warren. Considerable new machinery will be wanted.

ONEONTA, N. Y.—The Delaware & Hudson shops at Oneonta are to be enlarged. A new machine shop, steam heating and power station, and electric light plant have been decided upon and work will be begun at an early date.

OSWEGO, N. Y.—The New York Central is said to be preparing plans for improvements at the shops and yards here. A coal trestle is being built and plans are under way for a new engine house to have 25 stalls.

PELAHATCHIE, MISS.—We are told that the Alabama & Vicksburg R. R. has made no decision in regard to building shops at this place. If the work is done, about 50,000 will be spent.

PEORIA, ILL.—In regard to the report that the Peoria & Pekin Union will build a new roundhouse in Peoria, we are told that the plans are not yet completed.

PITTSBURGH, PA.—The Philadelphia Co. has let a contract to the American Bridge Co. for a large power station to be built on Brunot's Island. It is proposed to have a total capacity of 60,000 h.p. The first section of the station to be built at once will have 20,000 h.p. The contract for the station calls for the use of 1,200 tons of structural steel. The power generated will be used for the traction lines operated by the Philadelphia Co.

The foundry department of the Scaife Foundry & Machine Co., Ltd., was destroyed by fire June 30, causing a loss of about $50,000.

The City Council on July 9 granted the Baltimore & Ohio facilities to build a passenger station. The present station will be moved and be used as a freight office.

POTTSVILLE, PA.—The New Eastern Steel Co. has bought the old Pottsville Iron Steel Works, and, according to report, will make extensive improvements.

RICHMOND, VA.—Fire on June 26 completely destroyed the car sheds of the Richmond Passenger & Power Co. Quite a number of cars were also destroyed.

SAN FRANCISCO, CAL.—Plans for some of the buildings to be built by the Angels Iron Works in the West End, on Main street, are made. The machine and blacksmith shops and the foundry will be of steel construction. Contracts for the latter have not yet been let.

The Samson Iron Works in this city intends to build a $50,000 plant as soon as a site can be secured.

SOUTH NORWALK, CONN.—The United States Foundry & Sales Co. was incorporated in New Jersey July 7, with a capital stock of $150,000, to operate an iron and steel plant in South Norwalk. The temporary address of the United States Foundry & Sales Co. is 15 Exchange place, Jersey City, N. J.

SPARTA, ILL.—The Illinois Southern, according to report, will spend about $250,000 on shops and yards in Sparta.

WASHINGTON, D. C.—Capt. John S. Sewall, Corps of Engineers, U. S. A., who has supervised the construction of the new Government Printing Office, now almost completed, has been assigned to the duty of supervising the erection of the Army War College building, which is to be at Washington Barracks, Washington, D. C., near the Engineer School of Application. About $1,125,000 has been appropriated for the improvement of the Washington Barracks reservation under a general plan prepared by Mr. McKim, the architect, who was a member of the Washington Park Commission, and about $400,000 of this amount will be used for the War College building under Capt. Sewall's direction. The building will be on the large plaza on the northern section of the grounds opposite the entrance at the foot of Four and One-half street. Working plans will be prepared at once, and it is expected that the corner stone of the building will be laid within a few weeks. In addition to this building a large building will be erected for the Engineer School of Application.

The bill providing for a union passenger station at Washington, D. C., which passed the U. S. Senate during the session just ended, failed to pass the House of Representatives, and consideration of the project was postponed until next winter on account of lack of time to fully go into the matter. The House Committee unanimously recommended a site on C street in preference to the one a little further north on Massachusetts avenue, which was provided for in the Senate bill.

The Capital Traction Co. last week offered to sell the old power house site between 13½ and 14 and D and E streets, N.W., the site specified in the bill authorizing a municipal building for Washington for $550,000, the amount authorized in the bill. The site matter being settled a conference will be held at once between the Commissioners of the District of Columbia and the Secretary of the Treasury to arrange for a competition of architects to secure plans, the programme for the competition to be drawn up by the Supervising Architect of the Treasury.

WICHITA, KAN.—The Kansas City, Mexico & Orient is said to have bought land in this place for a site on which to build its shops.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xviii.)

Pacific Northwest Society of Engineers.

The Pacific Northwest Society of Engineers held its regular monthly meeting at the Chamber of Commerce rooms in Seattle on Saturday, June 7, at 8 o'clock p.m.

The meeting was presided over by Mr. R. H. Thompson, President. A paper was read by Mr. Charles F. Bihler, Consulting Engineer at Tacoma (formerly Division Engineer of the Northern Pacific Railway Company), on the Strength of Piles. Mr. Bihler had made a large number of experiments on small tapered columns of the same proportions as piling, and had plotted the results in comparison with the curves for the strength of long columns by the various formulæ for timber. The paper treated the ordinary column formulæ for timber, and the experiments which had been made in the past, and then the method of experiments on the tapered columns was explained in detail, and a resume of the results given. The paper was discussed at length by a number of the members present, and the meeting adjourned to meet the first Saturday in July, to hear a paper by Mr. Frank W. Hibbs, Naval Constructor, U. S. Navy, on the Comparative Strength of Yellow Pine and Puget Sound Fir.

The Society has received applications for membership from Engineers all over the northwest, and large additions are made to the roll at each meeting.

PERSONAL.

—Mr. Leverett Brainard, a Director of the New York, New Haven & Hartford, died July 2. He was born in 1828 in Colchester, Conn. Mr. Brainard was appointed head of the World's Fair Commission for Connecticut.

—Mr. T. A. Lawson, the new Assistant General Superintendent of the Chicago & North Western, has been the Superintendent of the Wisconsin Division of this company for the last seven years, and before that he was the Assistant Superintendent of the same division. Mr. Lawson is a native of Wisconsin, having been born in Mineral Point in 1861. He began his railroad career as a telegraph operator in 1878. He was for a time the train despatcher at Baraboo, but later became despatcher at Chicago. From this position he was promoted to that of Assistant Division Superintendent, then Division Superintendent, and now to the Assistant General Superintendency of the North Western system.

—The Prussian Minister of Public Works since 1890, von Thielen, has been retired at his own request, retaining the rank and title of Minister of State, and receiving the order of the Black Eagle. Not long ago we gave some account of the celebration of his 70th birthday, and of his railroad career. At that time he had but just recovered from a serious illness. He is succeeded as Prussian Minister of Public Works and head of the Imperial Railroad Bureau by Maj.-Gen. Budde, a soldier from his youth, now aged 51, since 1882 an officer of the General Staff, and for nearly four years chief of the Railroad Division of the General Staff. He left this position and resigned from the army in December, 1900, to become the manager of a company manufacturing arms and ammunition. At that time his knowledge of railroad affairs was remarked as extraordinary.

—Mr. C. H. Cartlidge, who was recently appointed Bridge Engineer of the Chicago, Burlington & Quincy, was born in Hannibal, Mo., in 1869. In July, 1886, he entered the service of the Kansas City, Memphis & Birmingham as a rodman. In October of that year he was on preliminary survey for the Kansas City & Omaha in Nebraska, but returned to the Kansas City, Memphis & Birmingham in December as material agent on construction, later being appointed inspector of erection of bridges. In 1888, he was appointed Deputy County Surveyor of Buchanan County, Mo., and two years later he entered the service of the Chicago, Burlington & Quincy as a draftsman on bridges and has continued with this company ever since. During the past four years Mr. Cartlidge has had charge of the designing of all bridges on the system under the direction of the late Mr. Blake.

ELECTIONS AND APPOINTMENTS.

Alabama Great Southern.—See Queen & Crescent.

Arkansas & Choctaw.—W. S. Jones has been appointed Assistant to the President and General Manager, with headquarters at Hugo, Ind. T.

Atchison, Topeka & Santa Fe.—James E. Hurley has been appointed General Superintendent Eastern Grand Division, with headquarters at Topeka, Kan., succeeding C. F. Resseguie, resigned. D. E. Cain has been appointed General Superintendent Western Grand Division, with headquarters at La Junta, Colo., succeeding Mr. Hurley, and Mr. Cain in turn is succeeded by A. E. Sweet as Assistant to the General Manager. Mr. Sweet was heretofore Trainmaster.

Atlanta & West Point.—J. P. Billups, heretofore Acting General Passenger Agent, has been appointed General Passenger Agent.

Boston & Albany.—W. B. Leach has been appointed Division Master Mechanic, with headquarters at Springfield, Mass., succeeding C. H. Barnes, resigned.

Buffalo & Susquehanna.—Secretary F. A. Lehr will also assume the duties of Treasurer, succeeding E. O. Cheney, resigned.

Canadian Pacific.—George McL. Brown has been appointed Superintendent of Sleeping, Dining and Parlor Cars, with headquarters at Montreal, succeeding J. A. Sheffield, resigned.

Chicago & North Western.—R. Matters has been appointed Superintendent of Dining and Parlor Car Service, with headquarters at Chicago, succeeding E. A. Kellogg, deceased.

Chicago, Burlington & Quincy.—C. R. Van Brunt has been appointed Superintendent of Buildings, with headquarters at Galesburg, Ill., succeeding W. A. Boydston, resigned.

Cincinnati, New Orleans & Texas Pacific.—See Queen & Crescent.

Grand Trunk.—C. J. Crowley, Resident Engineer, with headquarters at Detroit, Mich., has resigned.

Gulf & Ship Island.—L. A. Washington, Chief Engineer, with headquarters at Gulfport, Miss., has resigned.

Hocking Valley.—E. J. Powell, heretofore Foreman Locomotive Repair, has been appointed Master Mechanic.

Kansas City, Memphis & Birmingham.—M. Sheehan has been appointed Assistant Superintendent, with headquarters at Birmingham, Ala.

Mexican Central.—At a meeting of the Board of Directors, held in New York, June 30, Gabriel Morton, Vice-President, was elected Comptroller, and Jas. Piper Clerk of the Board, succeeding J. T. Harmer, resigned. The Financial and Accounting Offices have been transferred from Boston, Mass., to St. Louis, Mo.

Michigan Central.—W. S. Kinnear, Assistant Division Superintendent, with headquarters at St. Thomas, Ont., has been appointed Assistant General Superintendent, with headquarters at Detroit, Mich., succeeding A. B. Atwater, resigned.

Missouri Pacific.—W. J. McKee has been appointed Superintendent of the Kansas & Colorado Pacific from Hoisington, Kan., to Pueblo, Colo., and from Hoisington to Great Bend, Kan., with headquarters at Pueblo. The office of Division Superintendent has been abolished.

Mobile & Ohio.—H. J. Titus has been appointed Superintendent of Dining Car Service, effective July 15.

New York Central & Hudson River.—Owing to the large amount of new work in progress the following General Inspectors have been appointed, effective July 3, to continue for the season of 1902: W. A. Pettis, General Inspector of Buildings; J. H. Watson, General Inspector of Bridges; H. Latimer, General Inspector of Masonry Work; A. M. Clough, General Inspector of Track, and C. A. Miller, General Inspector of Mechanical and Electrical Work. The Inspectors will confer with the Division Engineers on maintenance of way work, and Resident Engineers on contract work.

Northern Pacific.—G. F. Wentworth has been appointed Assistant Division Superintendent, with headquarters at Missoula, Mont.

Ottawa, Northern & Western.—H. B. Spence has been appointed General Superintendent, with headquarters at Ottawa, Ont.

Pittsburgh, Shawmut & Northern.—G. H. Jones has been elected Fourth Vice-President, succeeding B. E. Cartwright, resigned.

Queen & Crescent.—During the temporary absence of W. J. Murphy, General Manager, M. W. Maguire has been appointed Acting Assistant General Manager of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern Lines, with headquarters at Cincinnati.

St. Louis, Kansas City & Colorado.—W. B. Leeds (President of the Chicago, Rock Island & Pacific) has been elected President of the St. L., K. C. & C., also.

Skaneateles.—C. P. Hemenway, heretofore Trainmaster of the New York Central & Hudson River, has been appointed Superintendent of the Skaneateles.

Southern.—Since July 1 the railroad formerly known as the South Carolina & Georgia Extension has been operated as part of the Charleston Division. A. Tripp has been appointed Assistant Superintendent of this Division, with headquarters at Blacksburg, S. C. The line between Savannah and Jacksonville will be operated as a part of the Savannah Division.

Southern Pacific.—T. W. Heintzelman has been appointed Superintendent of Motive Power with jurisdiction over the following operating divisions: Western, Sacramento, Salt Lake, lines in Oregon, and Carson and Colorado, with headquarters at Sacramento, and P. Sheedy has been appointed Superintendent of Motive Power with jurisdiction over the following operating divisions: Coast, San Joaquin, Los Angeles, Tucson & Sonora Railway, with headquarters at Los Angeles. Wm. McKenzie becomes Superintendent of the River and Ferry Steamers with jurisdiction over all the floating equipment of the company on the Pacific System and lines in Oregon, with headquarters at West Oakland. H. H. Forney has been appointed Master Mechanic at Sacramento, succeeding Mr. Heintzelman.

Texas-Mexican.—T. W. Dodd has been elected Vice-President.

Virginia & Southwestern.—W. E. Allen has been appointed General Freight and Passenger Agent, with headquarters at Bristol, Tenn., succeeding W. B. Emmert, resigned.

Western Maryland.—W. S. Pierce has been elected President and F. A. Landstreet Vice-President and General Manager.

Wisconsin Central.—W. G. Menzel has been appointed Superintendent of Motive Power and Cars, with headquarters at Fond du Lac, Wis., succeeding F. C. Cleaver, resigned.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AKRON BELT LINE & CONNECTING RY.—This company was incorporated July 2 in Ohio, for the purpose of building or leasing a line of steam railroad to connect Preston, in Wayne County, Ohio, with Youngstown, passing through the counties of Wayne, Medina, Summit, Portage, Trumbull and Mahoning, a total of about 75 miles. L. C. Miller, C. D. Crouch, Francis Sieverling and others, of Akron, Ohio, are the incorporators.

ALABAMA GREAT SOUTHERN.—Permission of the State Railroad Commissioners has been asked for a spur line two miles long, to the De Bardeleben mines from Dudley in Tuscaloosa County, Ala.

ALABAMA ROADS.—Work is reported in progress on a lumber line two miles long to reach a saw mill at Attala, Ala. L. P. Lewis, of Attala, is the owner.

ALASKA CENTRAL.—According to most recent advices, it is the purpose of this company to build a road from Resurrection Bay, Alaska, about 75 miles east of the entrance to Cook Inlet, to Rampart on the Yukon, a distance over the route chosen of 500 miles. Preliminary surveys have been made already and five surveying parties are now going over the ground for the second time. The road runs through Government land all the way. Geo. W. Dickinson, Manager of the Seattle Street R. R. system, is President, and John H. McGraw, formerly Governor of Washington, is Vice-President. (May 9, p. 353.)

AUGUSTA & AIKEN (ELECTRIC.)—The first portion of this new electric line between Augusta, Ga., and Aiken, S. C., was opened June 28 as far as Clearwater, S. C., and it is expected that the entire line will be in operation within a week or so. Trackage rights have been secured in the city of Augusta over the lines of the Augusta Electric Ry. The distance from Augusta to Aiken by way of Clearwater is slightly under 20 miles.

BEACON MOUNTAIN.—Authority has been granted this company by the New York Railroad Commission to build a railroad four miles long from the terminus of the inclined road on Beacon Mountain, near Matteawan, N. Y., around the mountain. The new line will be designed entirely for pleasure traffic.

BELLINGHAM BAY & BRITISH COLUMBIA.—Bids were asked June 21 for building eight miles of additional road from Maple Falls, Wash., the present terminus of the line, to Glacier Creek, one mile inside the Mount Baker Forest Reserve. (April 25, p. 315.)

CAMPBELL, COAL & COKE.—An officer writes that this company is building a railroad 10½ miles long from a junction with the Nashville, Chattanooga & St. Louis, just north of Bridgeport, Ala., to their mines in Marion County, Tenn. Contract has been let and seven miles of grading completed. The work is not difficult. At the present time the company is in the market for 70 tons of 40-lb. rails, 25 tons of 16-lb. rails, and 25 tons of 12-lb. rails for immediate delivery at Bridgeport, Ala. J. B. Campbell, Atlanta, Ga., is Treasurer.

CENTRAL FLORIDA & GULF COAST.—According to most recent advices, this new line projected from Plant City, Fla., to Boca Grande, with a branch, a total of about 150 miles, is building between Plant City and Braidentown and Sarasota, approximately half of the projected distance. A mortgage to secure $2,000,000 of 5 per cent. 50-year bonds has recently been made to the Standard Trust Co. as trustee. Thomas H. McDonnell, of Quincy, Mass., is President, and J. H. Gawe, Plant City, Fla., is General Manager. (May 16, p. 372.)

CHEAT HAVEN.—This company was chartered in Pennsylvania to build a steam railroad two miles long from a point on the line between the States of West Virginia and Pennsylvania, along the east side of the Cheat River to a point at or near Cheat Haven. Robert C. Neal, Jr., of Harrisburg, Pa., is President.

CHICAGO & NORTH WESTERN.—Work was reported completed the last week in June on the double tracking between Arion and Logan, Iowa, 13 miles, affording a continuous double track line for the entire length of the State.

CHICAGO GREAT WESTERN.—The company has commenced building the cut-off from Waverly to Oelwein, Iowa. The cut-off will be 27 miles in length and will cut the town of Sumner off the Chicago-Omaha line. The engineering difficulties of constructing this cut-off are great and it is not expected to be completed for several months.

CHICAGO, ROCK ISLAND & PACIFIC.—A conference between representatives of the Chicago, Rock Island & Pacific, the Wabash, the St. Louis Terminal Association and other interested parties was held in New York July 9 relative to the question of terminals in St. Louis. The Rock Island was previously reported to have secured independent right of way from Forsythe Junction to Vandeventer avenue and Morgan street, St. Louis, by an arrangement with the Suburban Electric Ry., the steam roads to make use of their right of way over an elevated track. Since then announcement has been made that the Mercantile Trust Co. has purchased for the Rock Island all the property on the block bounded by Pine, Chestnut and Main streets and the Levee, with the exception of one lot. At the same time plans were filed with the Board of Public Improvements for a route to the Union Station which involved crossing a handsome residence tract either above or below the surface. This proposed route would parallel the Wabash.

CLARINDA, COLLEGE SPRINGS & SOUTHERN.—Articles of incorporation were filed in Iowa July 2, 1902, for an electric or steam railroad from Blanchard, a point on the Wabash in the southern part of Page County, Iowa, to run in a northeasterly direction through College Springs, Clarinda, Greenfield and Winterset, to Des Moines, Iowa, a distance of 130 miles. The company expects to build from Blanchard to Clarinda this year and to extend the line to Des Moines within the next two years. The incorporators are E. B. Dunham, Will Anderson, A. P. Tukey and others, of Clarinda, Iowa.

CLEVELAND, PAINESVILLE & ASHTABULA ELECTRIC.—According to most recent advices, this road which was formerly part of the Everett-Moore syndicate, and on which some work has been done, has been purchased by a syndicate headed by W. J. Hayes & Co., of Cleveland, and will be completed as projected. The plans call for a line about 30 miles long running chiefly on private right of way between Painesville and Ashtabula, and securing trackage rights on the Cleveland, Ashtabula & Eastern between Painesville and Cleveland. A connection is also made at Ashtabula with the Pennsylvania & Ohio Electric. This will be a link in the through electric chain which is being built between Cleveland and Buffalo, and it is expected that communication will be established within a year. Luther Allen, of Cleveland, is President.

COOS BAY & SALT LAKE.—It is said that work will begin at once on a projected railroad from Coos Bay, on the Pacific Coast, Ore., to Grant's Pass, Josephine County, about 80 miles southeast. A project which may be the same was reported in our Construction Supplement under the title of Coos Bay, Roseburg & Eastern, with the intention of building from Myrtle Point, Ore., by way of Remote and Camas to Roseburg, 70 miles. Myrtle Point is southeast of Coos Bay on the direct route to Grant's Pass, and Roseburg is almost due north of Grant's Pass. L. V. Kinney, of Portland, Ore., is interested.

DELAWARE, BERKSHIRE & SUNBURY.—It is said that work will be begun at once on this new line in Ohio, to run between the points named, a distance of 12 miles, through a country which is at present without railroad facilities.

DELAWARE VALLEY TRACTION.—An officer writes us that the projected mileage of this new line in Pennsylvania, which is to be built by the Crystal Springs Mining & Milling Co., will be 33 miles long, of which 21 miles is to be built at once, and will probably be finished during the fall. The remaining 12 miles will be built next spring, according to present plans. No contracts have as yet been let and the company will probably do its own work after buying material. W. F. Sadler, Jr., Trenton, N. J., is Secretary.

DENVER & RIO GRANDE.—General betterment of the line is in progress between Denver and Ogden, Utah. At Lathrop a realignment of the track is being made for a distance of nine miles. At present the track follows the right bank of the river, but the changes include the building of a bridge of two 40-ft. spans 50 ft. above high water above Lathrop. A second crossing of the river is made where a steel bridge 50 ft. high is being built. At Minturn the track is being straightened and a second track is being laid for five miles. Three steel bridges will be built shortly at Eagle, Glenwood Springs and Grand Junction. Work is also being pushed on the Hotchkiss Branch, and grade and curvature is being reduced at Jordan Narrows, 30 miles south of Salt Lake City. Between Denver and Lakespur, 45 miles, the entire road-bed is being straightened and new ties and ballast are being put in. It is estimated that the improvements, when completed, will almost double the hauling capacity of the locomotives.

EASTERN OF ALABAMA.—It is said that contracts for this proposed line to run from Tallageda to Pyriton or other point in Clay County, Ala., will be let in a couple of weeks. The distance from Talladega to Pyriton is about 25 miles. P. H. Smith, of Talladega, is President. (June 13, p. 454.)

FORT SMITH & WESTERN.—This new line is reported completed from Fort Smith & Western Junction, below

Fort Smith, Ark., to McCurtain, Ind. T., 20 miles west, and a train service has been established between Fort Smith and McCurtain by the use of the Kansas City Southern tracks out of Fort Smith. Work is reported in rapid progress between McCurtain and Guhtrie, Okla. T., and it is said that the entire distance, 173 miles, will be running next summer. The grade is said to be less than half of 1 per cent., and the line is quite free from curvature. Geo. Hayden, Ishpeming, Mich., is President.

GEORGIA, FLORIDA & ALABAMA.—It is said that an extension will be built from Tallahassee to Tampa, Fla., 130 miles, by way of Perry, Oldtown and Brooksville, with a branch from Oldtown to Archer. The line is now in operation between Arlington and Tallahassee, 81 miles, and is under contract between Arlington and Columbus, Ga., 90 miles, to Davidson & Hardaway, contractors. The last portion of the line to Tallahassee was completed a short time ago. From Tallahassee south the building will be under the charter of the Florida Southeastern, incorporated June 15. (March 28, p. 235.)

HALIFAX & YARMOUTH.—It is reported that Mackenzie & Mann have gone to Halifax, N. S., to begin work on this line. Commencement is to be made at Mahone Bay, and the 60 miles between that place and Halifax will be the first section built. The entire proposed length is slightly over 100 miles, all of which has been surveyed. Mr. Mackenzie is quoted as saying that 10,000 tons of steel rails have been purchased at Montreal and the same quantity from the Clergue Works at Sault Ste. Marie. The Atlantic coast will be followed as closely as possible along the western shore of Nova Scotia, and entrance to Halifax will be secured by trackage rights over the Intercolonial. (April 11, p. 227.)

ILLINOIS & MISSISSIPPI.—Further details concerning this company incorporated in Illinois on May 31, for the purpose of building a road from Rock Island, Ill., to Peoria to connect at the latter point with the Des Moines, Iowa City & Eastern, recently incorporated, indicate that preliminary surveys are now being run from Peoria to the Mississippi River. M. P. Breen, 218 La Salle street, Chicago, is President, and the headquarters of the company are in that city. (June 13, p. 454).

ILLINOIS CENTRAL.—An officer denies the current press report that a line is to be built from West Point, Miss., to Winfield, Ala.

IOWA & DAKOTA CENTRAL.—A corps of surveyors are at work in the vicinity of Centerville, Iowa, surveying the route of this company in a northwesterly direction toward Sioux City, Iowa. The proposed route is through Mystic and Chariton to Des Moines, and from Des Moines to Sioux City. The intention of the officials is to build a portion of the line this year.

JAMESTOWN & CHAUTAUQUA.—The new line from Westfield, N. Y., to Mayville, on Lake Chautauqua, 10 miles, has been opened for business. The contractors were Vandergrift & Co., of Philadelphia. (Construction Supplement, March 14, 1902.)

KNOXVILLE, LAFOLLETTE & JELLICO.—It is said that contract will be let at once for the projected line between Knoxville and Clinton, Tenn., 18 miles. Contract was let to the Callahan Construction Co. for the 11-mile section between Lafollette and Jellico last April, and surveys are now being completed on the 23-mile section between Clinton and Lafollette. The entire length of the line when completed between the three points named will be about 52 miles. It is being built in the interest of the Atlanta, Knoxville & Northern. John D. Newton, General Manager of the Atlanta, Knoxville & Northern, is President.

LAUREL & ELLISVILLE.—Grading is reported in progress on this new line, which was incorporated last May, between the points in Mississippi named. The Laurel & Ellisville is a lumber road, although it will carry passengers and general freight as well. The air line distance to be covered is not over 10 miles. (May 9, p. 354.)

LOUISIANA & NORTHWEST.—It is said that work will be resumed at once on this projected line, which is to run from Bienville, La., southwest by way of Grand Ecore to Natchitoches, 37 miles. Eight miles of the line are at present completed south of Bienville, and it is hoped that the entire road to Natchitoches will be opened by the first of October. Track is to be laid on the grade as it advances.

MAGNOLIA-LIBERTY.—It is said that arrangements are being made to build a railroad between these points in Mississippi, 30 miles apart. Liberty, which is the county seat of Amite County, is at present without railroad communication. The names of interested parties are not stated.

MEXICAN CENTRAL.—General Manager Nickerson is quoted as saying that there is practical certainty of building a short line to the United States border which will probably terminate at San Antonio, Texas. (May 9, p. 354.)

MILLEN & SOUTHWESTERN.—It is said that contracts will be let soon for 50 or 60 miles addition of this line, which is projected between Stillmore and Waycross, Ga., and in an easterly direction through Burke and Screven Counties, to some point at or near Sylvania, 35 miles, and northwest from Sylvania to some point on the Savannah River. (Jan. 17, p. 50.)

MINNEAPOLIS, SUPERIOR, ST. PAUL & WINNIPEG.—President Roosevelt has signed a bill authorizing this company to bridge the Mississippi a short distance above Minneapolis.

MT. ROGERS & EASTERN.—Grading for this projected line in Virginia is reported in progress in Grayson and Carroll counties. The plans of the projectors call for a line from Bristol to the seacoast, in the eastern part of Virginia, to parallel the Norfolk & Western. The company was incorporated about a year ago and considerable amounts have been voted to aid its building by towns along the route. (Construction Supplement, March 14, 1902.) A. A. Campbell, L. A. Sebastian, S. C. Plummer and others were the original incorporators.

NEW JERSEY TERMINAL.—This road, incorporated at Trenton in October, 1901, was opened between South Rahway, N. J., and Carteret, a distance of about four miles, on July 4. Work has been under the direction of Louis Focht, of Trenton.

NEW YORK CENTRAL & HUDSON RIVER.—Purchase of a piece of farm property located in the town of Manlius, N. Y., is reported and it is said that an extension to the DeWitt yard, to be approximately the size of the original yard, will be built on the land.

NEW YORK RAPID TRANSIT.—The Rapid Transit Commission advertises for proposals to build and operate under a 35-year lease, with privilege of renewal for 25 years, a two-track tunnel extension of the Rapid Transit Subway from a connection with the Manhattan-Bronx line at the intersection of Broadway and Park Row to the Battery, and thence under the East River and under Joralemon and Fulton streets, Brooklyn, to the Flatbush avenue station of the Long Island R. R. Work must be begun within two months and completed within three years' time, with a possible extension of one year for work under the East River. A certified check for $100,000 must accompany proposals and the successful bidder must give $1,000,000 security for building, and additional security of a like amount to cover continuance of work, operation, payment of rent, etc. The annual rent after completion will amount to the interest paid by the city on its bonds for the cost of building, including interest during building, but excluding certain bonds for easements, etc., and in addition to this, 1 per cent. on the cost of building. Proposals shall specify the maximum fare, not to exceed five cents, which may be charged a single passenger for a continuous ride on the whole or any part of the railroad, and shall also state what facilities can be offered for through transit over other roads for five cents or less. Bids will be received until noon, July 21.

NORFOLK & WESTERN.—In connection with the sale of stock of the Radford Southern to this company, it is said that arrangements have been made to build an extension of the Marion & Rye Valley R. R., 26 miles in Smythe and Grayson Counties, Va. The road will then extend 33 miles from Marion, on the main line of the Norfolk & Western, into Grayson County, and will open up a lumber and mineral region. Colonel Geo. W. Miles, Radford, Va., is President of the Marion & Rye Valley.

NORTHAMPTON & BATH.—This company was chartered in Pennsylvania July 7 to build a steam railroad from the Borough of Alliance, Northampton County, Pa., to the Borough of Bath in the same county. The capital stock is $70,000. The length of the proposed line is seven miles, and J. Rogers Maxwell, of New York, is President.

NORTHERN PACIFIC.—Grading is reported completed on the Park Branch, which runs from the present terminus at Cinnabar, Park County, Mont., to Gardner, three miles southeast on the north boundary of Yellowstone Park. (May 23, p. 386.)

NOSCOE RUN.—Charter was granted this company on July 1, to build a steam railroad 2½ miles long from a point on the line of the Pittsburgh, Carnegie & Western, near the junction of Noscoe Run and Cross Creek, Pa., along the general course of Noscoe Run, to a point on the farm of Sarah D. White, in Washington County, Pa. Wm. F. Sossong, of Carnegie, Pa., is President.

OHIO ROADS.—Contract for a railroad between Spencer and Deborah, Roane County, Ohio, eight miles, has been let. The Crescent Supply Co., of Marietta, is interested.

PACHUCA, ZACUALTEPAN & TAMPICO.—It is announced that three branches of this line recently acquired by the Mexican Central will be built at once. One of these will run from Lecheria to Tomas, on the Tampico Branch of the Mexican Central; another from Zacualtepan about 60 miles north, and the third about 50 miles northwest from Pachuca. (June 28, 1901, p. 474.)

PITTSBURGH & LAKE ERIE.—The new yards at Hazleton, Pa., were opened for traffic on July 1. The improvements have been two years in progress and were made necessary by the increasing business of the Pittsburgh & Lake Erie at Youngstown, Ohio.

PORTLAND CITY & OREGON (ELECTRIC).—It is said that this company will build an electric line up the Clackamas River, 18 miles from Eagle, Ore.

RICHMOND-WASHINGTON.—Double tracking of this line over its entire length from the Potomac River to Richmond, 115 miles, has been authorized by its owners—the Pennsylvania, Baltimore & Ohio, Chesapeake & Ohio, Southern, Seaboard Air Line and Atlantic Coast Line companies, each of which, in accordance with an agreement made last fall, acquired one-sixth of the entire capital stock of the Washington Southern, which is the portion of the line between the Long bridge across the Potomac at Washington and Quantico, Va., and one-sixth of the majority of the voting stock of the Richmond, Fredericksburg & Potomac, constituting the remainder of the line. It is said that the improvement will involve rebuilding part of the line to reduce curvature. (See Railroad News, Sept. 20, 1901, p. 660.)

ST. LOUIS & NORTHWESTERN.—This company was chartered in Missouri June 28, with a capital stock of $1,000,000, to build a railroad through the counties of Lynn, Chariton, Randolph, Howard, Boone and Callaway, from Brookfield to a connection with the Missouri, Kansas & Texas, at a point near Mokane, in Callaway County, a distance of about 100 miles. J. H. Baker, D. R. Patterson, H. G. Marquis and others of Salisbury, Chariton County, Mo., are directors.

SOUTHERN.—It is said that spur tracks from half a mile to two miles long will be built to the Galloway mines in Bibb County, Ala.; to the Bessemer Land & Improvement Co. in Bibb County; to the Ruby coal mines in Walker County; the Woodstock furnaces at Anniston, Ala., and to the mines of the Northern Alabama Co. in Talladega County.

SOUTHERN PACIFIC.—Announcement is made that a branch line 10 miles long will be built from Sour Lake Station, Texas, to the Sour Lake oil field. Surveys are being made.

About 16 miles of track have now been laid on the Ogden-Lucin cut-off. The track now reaches the water on the east shore of the lake and on the west side about two miles from grade. For illustration of this route, see Sept. 13, p. 644.

TEXAS & OKLAHOMA (MISSOURI, KANSAS & TEXAS).—An officer sends the following information about this company, incorporated May 15 in the interest of the Missouri, Kansas & Texas. It is proposed to build northwest about 90 miles from Oklahoma City, and arrangements for location and general plans for building are now being made. The work is rather heavy. Bids for new rails and rolling stock will be asked for soon. F. N. Finney, Milwaukee, Wis., is President, and C. C. Hedge, 49 Wall street, is the New York representative. No Chief Engineer has yet been appointed. (June 6, p. 422).

WABASH.—Contract for reducing grades and removing curves on the Chicago Division at several points has been let to Dean & Co., and it is thought that work will begin shortly. (April 25, p. 316.)

YOUNGSTOWN & SOUTHERN.—Articles of incorporation were filed in Ohio July 3. It is proposed to build a steam railroad from Youngstown through Mahoning and Columbiana Counties to East Liverpool, Ohio. East Liverpool is directly south of Youngstown and about 32 miles distant.

GENERAL RAILROAD NEWS.

ATLANTIC COAST LINE.—Sale is reported of $13,750,000 of the proposed issue of first consolidated mortgage 50-year 4s to Brown Bros. & Co., Hallgarten & Co., and Vermilye & Co. It is said that no more will be sold for the present. (May 23, p. 386.)

CHICAGO, BURLINGTON & QUINCY.—Sealed proposals are asked by the New England Trust Co., trustee, for the sale of Denver extension 4 per cent. bonds, due in 1922, to the sum of $92,614.81. Proposals will be opened and successful bids declared July 15, and interest on accepted bonds will cease on the following day.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—Notice is given that the holders of more than 51 per cent. of the capital stock have accepted the offer submitted in the circular of the Louisville & Nashville, and of the Southern, dated May 20, and have deposited their shares, such deposit constituting final acceptance of the offer of purchase therein made. The time for depositing stock is extended to and including July 31, 1902, after which date deposits will be accepted, if at all, only on such terms as the railroad companies may prescribe.

CHICAGO, ROCK ISLAND & PACIFIC.—At a recent meeting of the directors it was voted that shareholders of record July 21 should be allowed to subscribe at par for $8,235,000 new stock in amounts equal to 12½ per cent. of their present holdings. An increase of $15,000,000 in the capital stock was authorized on June 4, and of this $3,381,200 has been issued to take up Burlington, Cedar Rapids & Northern stock, $502,800 for Rock Island & Peoria stock, and $2,000,000 for the purchase of the St. Louis, Kansas City & Colorado. After the present subscription there will remain $880,500 in the treasury. The proceeds of the new stock is to be used chiefly for new road in the southwest, but a portion of the proceeds may be applied to second track and other permanent betterments, and for equipment, etc. (See Chicago, Rock Island & Texas, June 13, p. 454.)

An order has been issued by President Leeds changing the official title of the road from the Rock Island Route to the Rock Island System.

FAYETTE COUNTY.—The Baltimore & Ohio, which formerly operated this line under lease, has taken over the stock at the rate of $150 per share of $50, making a total cost of $324,000. The road runs between Uniontown and Connellsville, and is 12 miles long. A suit to annul the lease had been undertaken.

MASSACHUSETTS ROADS.—The Massachusetts Railroad Commissioners have approved the purchase of the Upton Street R. R. by the Grafton & Upton R. R., under a special act passed by the Legislature, this being the first instance in the State of the absorption of an electric by a steam railroad. The Grafton & Upton is a standard gage line which runs from a connection with the Boston & Albany at North Grafton, Mass., to a connection with the New York, New Haven & Hartford at Milford, 16 miles. The property purchased is appraised at $35,000. The act also permitted the lease or purchase of the Milford, Holliston & Framingham road by the Milford & Uxbridge, but no petition for approval of this action has yet been filed. At the same time that the order above was issued, however, another was issued upon a petition filed some time ago, and this permits the Milford & Uxbridge to purchase the Milford, Holliston & Framingham road and issue $250,000 stock in exchange, share by share.

METROPOLITAN WEST SIDE ELEVATED (CHICAGO).—Extension mortgage 4 per cent. gold bonds dated July 1, 1901, and due in 1938, are offered by the First National Bank of Chicago, and Lee, Higginson & Co., of Boston, at 97 and interest. The Northern Trust Co., of Chicago, is trustee for these bonds, of which the authorized issue is $5,000,000. At the present time $1,500,000 are outstanding, and $1,500,000 offered as above. The remainder can only be issued to pay for new mileage and additions to the property. The bonds are secured by a first mortgage on the Douglas Park and Garfield Park extensions, which include about 2.3 miles of double track elevated road, and also by 46 passenger cars of which eight are motor cars, and a new 3,500 h.p. engine. They are also a first lien upon a new downtown terminal, situated in the heart of the downtown business section, for which the company has recently acquired real estate costing approximately $900,000, and they are a lien, subject to $10,000,000 first mortgage bonds, upon all the company's property and franchises. The proceeds of the bonds are to be applied to defraying the remainder of the cost of the Douglas Park and Garfield Park extensions mentioned above, and the cost of the terminal, together with the real estate involved. The new terminal will enable the company to accommodate a larger number of passengers and avoid the expense of sending many trains around the Union loop used in common with the other elevated roads.

NORFOLK & WESTERN.—On July 1 control was assumed over the Iæger & Southern R. R., which runs from Iæger to Ritter, W. Va., five miles into timber country, and over the Hillsboro, a line 20 miles long connecting the Norfolk & Western with the Baltimore & Ohio at Sardinia, Ohio.

SAGINAW VALLEY TRACTION.—N. W. Harris & Co. offer $600,000 5 per cent. first mortgage sinking fund gold bonds, dated Jan. 10, 1899, and due Feb. 1, 1920, for which the Boston Safe Deposit & Trust Co. is trustee. The Saginaw Valley Traction Co. owns all of the street roads in Saginaw, Mich., and is the only electric line between Saginaw and Bay City, serving a population of about 90,000. Results of operations for the year ending March 31, 1902, show gross receipts of $277,536, and net earnings of $9,792, after deducting $186,743 operating expenses and taxes.

SOUTHERN.—Announcement is made under date of June 30 that the company has made contract for joint use of the line of the Atlantic Coast Line between Savannah, Jesup and Jacksonville, and that the trains of the Southern will be operated over this line on and after July 1. Announcement is also made under date of July 1, that the Asheville & Spartansburg, the South Carolina & Georgia, the Carolina Midland and the South Carolina & Georgia Extension roads having been consolidated as one corporation under the title of Southern Railway, Carolina Division, that corporation has leased the consolidated property to the Southern Ry., effective this date.

SOUTHERN PACIFIC.—Notice is given that the directors will use $64,000 now in the sinking fund, to redeem first consolidated mortgage 5 per cent. gold bonds, and bids are invited for the sale of these bonds. Bids must be deposited at the office of the Assistant Treasurer in New York before July 31, noon.

TEXAS & LOUISIANA.—Application to issue stock to the amount of $200,000 on a stretch of road about 25 miles between Lufkin and Windham, Texas, was filed with the Railroad Commission, June 25. A valuation of the road by an engineer of the Railroad Commission is required before action can be taken on the application.